UNIVERSITY OF MICHIGAN
DEC 23 1952
FORESTRY LIBRARY

INCLUDING ANNUAL INDEX

WORLD CROPS

embracing

AGRONOMY, HANDLING, PROCESSING, STORAGE AND PROTECTION
SOILS, CHEMICALS, IRRIGATION, ENGINEERING AND ECONOMICS

The Platypus 28 Tractor on Test in South Africa

VOLUME 4, No. 12 DECEMBER 1952

A Publication of The Leonard Hill Technical Group

Monsanto's growing range of agricultural chemicals is the result of careful laboratory research. These Monsanto products—for weed killers, wood preservatives, soil sterilizers—are of dependable quality and are backed by equally reliable advisory and delivery services.

Formulators and manufacturers are invited to write for further information to Special Products Department, Monsanto Chemicals Limited, Allington House, London, S.W.1.

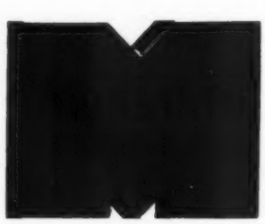
The Monsanto range of Agricultural Chemicals includes :—

2,4-D	*2,4-Dichlorophenoxy-acetic acid. Sodium 2,4-Dichlorophenoxyacetate-monohydrate.*	*Selective weed-killer.*	*Used for weed control in grassland, turf and cereals, etc.*
Santobrite*	*Sodium pentachlorophenate.*	*General contact herbicide.*	*Water-soluble, also useful in pre- and post- emergence weed control.*
Santophen-20*	*Pentachlorophenol*	*General contact herbicide.*	*For formulation as an oil emulsion spray. Particularly suitable for treatment of rail-tracks, roadsides & ditches.*
Santomerse*	*A wetting-agent used in formulation of sprays and wettable powders.*		
Cresylic Acids			
Chlorinated Cresylic Acids	*Soil sterilizers, all grades, blended to customers' requirements.*		
Methyl Salicylate	*As a masking agent for kerosene and other insecticide spray oils.*		
Permasan*	*A wood preservative to protect against insects and fungi. Applied by dipping, brush or spray.*		

*(*Registered Trade Marks.)*

MONSANTO CHEMICALS LIMITED,

Allington Hse., Allington St., London, S.W.1.



In association with : —
Monsanto Chemical Company, St. Louis, U.S.A.
Monsanto Canada Ltd., Montreal.
Monsanto Chemicals (Australia) Ltd., Melbourne.
Monsanto Chemicals of India Ltd., Bombay.

Representatives in the world's principal cities

Forestry
SI
1
.W 3
V.
195

WORLD CROPS

Editor: Sir Harold A. Tempany, C.M.G., C.B.E., D.SC., F.R.I.C.

Vol. 4. No. 12

CONTENTS

DECEMBER 1952

EDITORIAL COMMENT:
Cocoa Types from the Amazon; Botanical Exploration; U.S. Fibre Experiments; Desert Reclamation in Aden; The Good Earth; Salination in the Netherlands; Grass Sense; Nematodes; Space for Science; Readability and Agricultural Publications 399

Seaweeds—A New Source of Chemicals and Food—*F. H. Woodward*, B.SC., PH.D., F.R.S.E. 403

Bananas and Manila Hemp—*N. W. Simmonds*, M.A., A.I.C.T.A., F.L.S. 407

Decline of Plantation Agriculture in Indonesia—*John E. Metcalf* 410

The Organisation and Work of the Forest Research Institute of Sweden 413

New Books 417

Industry's Contribution to Agricultural Research—No. 12: The Ferguson Organisation—*A. B. Lees* 419

The Application of Electronics to the Cleaning of Agricultural Products—*D. M. Tombs*, M.SC., D.I.C., A.M.I.E.E. 422

Research Developments:
Storage Behaviour of Apples; Streptomycin Cures European Foulbrood of Bees; Safflower Seed Oil ... 425

Farm Machinery: 1952 Smithfield Show Preview 427

World Crop Reports 432

ANNUAL INDEX 433

Platypus 28 Tractor on Test in South Africa

The new tracklaying Platypus 28 Tractor, originally designed as a prime mover for the Howard Rotavator, is seen on the cover picture rotavating between rows of Granadillas (passion fruit) in an orchard in Zululand. The fruits are grown in terraces ten feet apart. The picture of this test machine was taken during the dry season when the ground surface was very hard.

Rotary Hoes Ltd., Horndon, Essex, England

Published monthly by Leonard Hill Limited, Stratford House, 9 Eden Street, London, N.W.1, England (Tel. Euston 5911)
Subscription rates : *1 year 8 dollars, 3 years 20 dollars, paid in advance*

SEE THESE MODERN MACHINES AT THE SMITHFIELD SHOW
STAND NO 187 1ST FLOOR

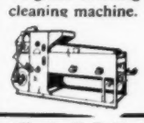
THE MOST COMPREHENSIVE RANGE OF ULTRA MODERN MACHINES FOR THE CLEANING AT ALL STAGES FOR ALL PURPOSES OF CEREALS, PULSES, SEEDS ETC.

FOR THE FARMER. MERCHANT. CANNER. EXPORTER. CONTRACTOR ETC.

"Scientaire" Pneumatic Pre-Cleaner. 2 sizes - 4/5 and 8/10 tons/hour irrespective of moisture content. Specially developed for the Combine user.

"Scientaire" complete unit comprising Intake Hopper, Feed Control, Elevator, Pre-Cleaner, Sacking off spouts and single driving unit.

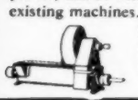
"Kaybee 50". 5 units in one machine. Self-contained grain dressing and seed cleaning machine. Capacity 2 tons/hour.



"Kaybee" General Separators. 4 types. 20 sizes. Capacities 1 to 80 tons per hour.

FOR THE SPECIALIST SEED GROWER. GRAIN MERCHANT. EXPORTER. CANNERS ETC.

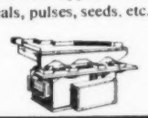
"Kaybee" Clipper, De-awner, Thrasher an essential first unit in all seed cleaning plants; can be fitted to most existing machines. Capacities from ½ to 5 tons/hour.



"Kaybee" Blue Velvet Small Seed Separator. Capacities 400/500 and 800/1000 lb hour. Exceptional efficiency, low power small space.

"Kaybee" Table Separator for Rice, Barley, Oats, Wheat, Coffee, Beans, etc. Separates shelled from unshelled, one sort from another. Capacities from 700/to 9000 lbs hour.

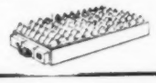
"Kaybee" Gravity Separator. The machine with many specialised applications on cereals, pulses, seeds, etc.



LABORATORY INSTRUMENTS FOR ALL — FARMER. MERCHANT. SEED GROWER & TESTING STATIONS

"Kaybee" Infra-red Moisture Tester (Patent). Accuracy with speed. Direct readings. Determinations from 0% to 100% to within ± 0·5 %. Tested and Guaranteed.

"Kaybee" Germinating Cabinets. In 3 sizes to take 48, 96 or 180 jars. Electrically heated with adjustable thermostatic control.



"Kaybee" Vacuum Seed Counters. Counting heads supplied for all sizes of seed. Indispensable in germination tests.

"Kaybee" Laboratory Cleaning Plant. 5 separate testing machines; scourer, huller aspirator, sieve separator, paddy separator, H.C. vlinder

The above are just twelve out of a range of over 100 modern machines specially designed for the cleaning and preparation of all types of cereals, pulses and seeds. Send for full particulars of these or of our complete range of rice, flour, barley, oat and provender milling machines. A complete Seed Testing Laboratory is at your service for testing and investigating your problems.

T.R.WALKER
BILBROUGH, YORK
Phone / Grams Tadcaster 2166

ALDRIN
DIELDRIN

now freely available

For outstanding control of

LOCUSTS
GRASSHOPPERS
ANTS
COTTON INSECTS
SOIL INSECTS
MOSQUITOES

Distributed by Shell in most countries of the world
Apply to your local Shell Company

Editorial Comment

Cocoa types from the Amazon

IN our issue for January last we commented on the vast potentialities of Brazil and in particular those of the great stretches of rain forest of the Amazon basin—the largest continuous stretch of this type of vegetation in the world—and the range of products of potential commercial importance at present unexploited which exist there.

Recent news from the West Indies indicates that a serious effort is likely to be made in the near future to explore the possibilities in one direction for the benefit of the cocoa industry, at present so seriously threatened in the West Indies and Africa by various plant diseases.

Travellers in the densely forested areas on the boundaries of Brazil, Colombia, Venezuela and Peru, which area includes part of the basin of the head waters of the Amazon and the Orinoco, are reported to have found cocoa plants growing there in the wild state. It is considered that this region may be the possible centre of origin of the genus *Theobroma* and that it may contain a wide range of new and hitherto unknown genotypes.

The study of these might greatly assist in the classification of the present known cultivated varieties and might also, one supposes, yield a wide range of new genotypes which could be employed in breeding new and improved types and varieties of cocoa.

The British West Indies Cocoa Research Scheme have considered the possibility of organising a team of scientists to study the wild cocoa of the region and to collect material for genetical study and for the improvement of cultivated types of cocoa.

It has been ascertained that the Colombian Government is not only willing to allow the team to explore the region in question so far as the parts of it under its jurisdiction are concerned, but is also willing to attach some of its own scientists to the team and to allow the use of its Estacion Agricula Experimentale at Palmire for the examination of material collected.

The areas to be explored are densely forested, sparsely inhabited and only partially known; the usual means of travel must be by canoe, so that the expedition is bound to be beset by difficulties and hazards. Let us hope that these will be surmounted, that the other governments concerned will be equally cooperative as have the Colombian authorities and the results of the expedition will be amply rewarding.

Botanical exploration

IN the past exploration of the regions of origin of various cultivated crop plants have yielded amazing results. As an example may be cited the botanical explorations in New Guinea and other parts of the Western Pacific region, which are the sites where the sugar cane was evolved; these have provided a wealth of material for sugar cane breeding work. Another example is the expedition to the Andean region in search of new varieties of the potato; this yielded a wide range of new forms which may in due time provide the world with a number of new types of potato.

More remote is the historic and picturesque story of the pioneer, Sir Henry Wickham, who brought out of the Brazilian jungle the seeds of the para rubber tree from which eventually originated the great plantation rubber industries of the Far East.

The Amazonian region contains, no doubt, numerous other treasures which could be gathered by intrepid botanical explorers. One need only mention the numerous palms of the *Attalea* type which flourish in these regions and which can yield vegetable oils of admirable quality once the initial difficulty has been overcome of devising an economic process for cracking the nuts. Recently a Brazilian journal called attention to the economic possibilities which await the exploitation of the Babassu palm, *Attalea funifera*.

In any case the move now contemplated to launch the projected cocoa expeditition in these regions will, no doubt, if it succeeds, be a powerful incentive towards stimulating similar research in other directions.

U.S. fibre experiments

FIVE fibres are mentioned in the latest official report on the United States stockpiling programme as being strategic and as the object of efforts to increase production. These are extra long staple cotton, abaca, kenaf, true hemp and sansevieria. The first named has so far been mainly derived from Egyptian sources. A vigorous programme of plant breeding and variety testing for improvements in yield, fibre quality and other characteristics is being conducted.

It is remarked of the scheme for abaca cultivation, which is being undertaken in Latin America at the request of the Reconstruction Finance Corporation, that it is still too early to have appreciable results. The programme, which was started some years ago, has had to include experiments in fertilisation, drainage, insect and disease control and general cultural practices.

The problem of disease control has been also prominent in the case of kenaf, which at present is the most favoured possible substitute for jute. This member of the hibiscus family was attacked during 1951 by a fungus disease which seriously affected plantations in Cuba and Florida. The trouble reduces both the yield of fibre and the production of seed. It rather looks as though eliminating this disease may take a considerable time; for hope seems to be put chiefly upon evolving a strain of kenaf which is immune.

Efforts in connection with true hemp (*Cannabis sativa*) have been also mainly of the nature of devising improved strains, but here the motive has not been so much the bringing into existence of disease proof plants as those having a 'low marihuana content.' This last is an unfamiliar term, and more light could be thrown upon it with advantage.

The fifth of the fibres is sansevieria, which is claimed to be the best known substitute for abaca and suitable for commercial production in Florida. There are a number of varieties of this plant, one of which, the Guinea, has periodically awakened great expectations in the fibre world for the past 45 years or more. The report does not mention by name the sansevieria which is the latest choice for experimentation, but the information is given that the one chosen is tolerant of cold.

Desert reclamation in Aden

A REPORT* recently issued by the Colonial Office gives an account of progress made in the reclamation for agriculture of an area in the Aden Protectorate in Southern Arabia.

The area in question is known as the Abyan Delta and it is situated in the western part of the protectorate; the annual rainfall is only about 2 in., but at certain seasons of the year two rivers, of which the Bana river is much the most important, come down in flood and make possible cultivation on the flooded land.

For many years the area in question was occupied by Arab tribes whose internecine feuds made any substantial progress impossible, and only about 1,000 acres were actually under cultivation, but during the course of the war the necessity of increasing food supplies led the British Government, as protecting power, to undertake developments for the improvement of agricultural production, with the help of a loan of £270,000 from the Colonial Development Fund. As a result irrigation was improved and the cultivated area extended. Since the end of the war further progress has been made; a beginning was undertaken with Egyptian cotton cultivation which was found to grow well on irrigated land. In 1947 the Abyan Board was created by the Governor of Aden as the special agency for agricultural development which established a share farming system with the local Arab tribesmen and financed developments such as irrigation improvements, the erection of buildings and made cultivation advances, etc.

So great was the success of cotton cultivation that in 1951 the Raw Cotton Commission advanced £90,000 to the Abyan Board without a Government guarantee.

Last year the Secretary of State for the Colonies appointed a mission consisting of his Agricultural Adviser and the advisers on soils and irrigation to visit Abyan and examine the technical problems involved and to make recommendations for modifying and improving the conditions. In their report they took a favourable view of the prospects and recommended the provision of a further £350,000 for development, making a large number of practical proposals.

Abyan gives promise of becoming an area of development where formerly drought and tribal warfare brought misery to its scattered inhabitants. It is but an extension of the many developments which have taken place under British initiative and which have only too often been made the subject of unjustified reproach both inside and outside the Commonwealth.

*Report on the Abyan Scheme, 1951. Colonial No. 283. H.M.S.O., 1952. 8s. 6d.

The good earth

DR. George Cressey, President of the International Geographical Union, has this year expressed belief that the world's population in the year 2000 should have enough to eat but their food will come from the already known farming lands rather than from newly developed land. 'The good earth is essentially all in use, the major map boundaries of cultivated land have become stabilised.' From that land the world will have to secure greater yields. Developing the cropping potentialities of the Amazon, Congo, and Arctic regions lies far ahead in the future.

The unhappy series of failures to produce crops or eggs in unfamiliar parts of Britain's colonies certainly lends support to these views of a geographer. Agricultural scientists are unlikely to disagree provided that a wide enough definition of already-cultivated land is the basis of argument, for it is still only in certain countries that farming is conducted with some reasonable application of modern technical knowledge. Long-term efforts to develop new land, to adapt crop varieties to different climatic conditions, involve many more risks than enthusiastic idealists are prepared to concede; even if ultimately some addition to world food supply is secured from new and perhaps distant parts of the world's surface, there is no small chance that new methods of food production—synthesis, micro-biological conversions, the use of algae, etc.—will bring significant changes in the economic background to food, changes that would kill the prospects of marketing crops from the new lands. Admittedly an urgent need for more food faces the world as a whole and most seriously threatens all the tradionally food-importing countries. It is surely common sense to develop all the known land to its fullest productive capacity before rushing dangerously and with wishful hopes into the marginal and less than marginal areas of world surface. A man does not change his house because it is overcrowded when he already has a spare room.

Dr. Cressey urged geographers to complete an adequate inventory of land potentialities. Despite the estimates made as to acreages of arable land, likely crop outputs, and of world population figures, we still did not possess really reliable and fundamental information about the world's soils.

Salination in the Netherlands

ALTHOUGH the new Amsterdam-Rhine Canal, the last section of which between Jutphaas and Tiel was officially opened a few months ago, was constructed primarily for commercial purposes, it will be of great importance also from the water supply point of view. Not only will it help to supply a number of large towns with fresh water but it will also come as a relief to Dutch agriculture, one of whose chief menaces is a high salt content of water and soil.

About halfway along the canal, near Jutphaas, a pumping station is to be built by means of which some 70,000 cu. m. of water will be drawn daily from the canal, which will be

taken through a 1.25 m. diam. pipeline to Leiduin, where it will be subjected to desalination and purification. Although at Jutphaas the Amsterdam-Rhine Canal is some distance inland its water is still subject to salination from the North Sea. It is a striking fact that the amount of salt carried into the canal in the passing of a single steamer through the Ymuiden Lock is equivalent to five train-loads. Salt is also carried inland up the river estuaries, and, from these inland waterways and from the indented coastline, seeps through the soil for a considerable distance, saturating the surrounding land.

The damming of the Zuider Zee has considerably reduced the influx of salt. A century ago the Netherlands sea coast had a length of 1,905 km., now it is only 1,300 km., and further steps are to be taken to shorten the line still more. The damming of the ' Brielse Maas ' is another important step towards desalination of Dutch inland waters.

In fresh water supplies to Holland the Rhine is a vital link and in dry seasons the amount available is insufficient. To supply the Amsterdam-Rhine Canal with fresh water two enormous drains are being built, one on each side of the new Tiel Lock. Through these 50 cu.m. of Rhine water will enter the canal every second, independent of the lock chamber or the 190-ton vertical gate.

Unfortunately, the salt content of Rhine water has increased over the last 50 years to over 250 mgm. chlorine per litre. The Ruhr and Alsatian industries have caused increasing pollution and it is understood that consultation at an international level may be contemplated with the object of persuading Germany and France that the Rhine, as a source of high purity water, is essential for Dutch existence.

Grass sense

SOME simple but highly important experimental work on grass production has been reported from the West of Scotland Agricultural College at Auchincruive (I. V. Hunt, *Scottish Agric.*, 1952, **32**, 2, 92). To obtain the maximum output from grassland, both in quantity and quality, the grass must be rested at intervals during the growing season. Frequent cutting, of which of course continuous grazing is an extreme example, means low output. In these experiments plants of perennial ryegrass were cut with various frequencies and to different heights; for each system of cutting during the April-September period the weights of root and shoot per plant were determined. Cut once every 30 days to a level of 1 in., ryegrass plants produced 67.63 gm. of shoot over the period; but when cut with the same frequency but to a level of ½ in. the plants produced only half this—31.83 gm. At 10-day frequency of cutting the plants were far less productive. For 1 in. height of cutting the plants produced 6.04 gm. of shoot and for a ½ in. height 4.72 gm. These yields are greatly different and they demonstrate more vividly than any other evidence we have seen the modern principle that management is the most important influence in grassland farming.

The effects of cutting upon root growth were just as remarkable. With cutting at 30-day intervals and to the 1 in. level, root growth was able to reach a maximum weight of 23.25 gm. per plant in August; cutting to the ½ in. level, the maximum weight of root attained per plant was only 4.08 gm. When cutting took place at 10-day intervals, root weights hardly increased. Maximum weights were reached early in May—2.01 gm. for 1 in. cutting and 1.2 gm. for ½ in. cutting—and subsequently gradual loss in weight took place. The heavy drain upon the food-store in the roots imposed by frequent cutting is self-evident from these figures. Nor can the root merely be considered as a food reserve for the plant. Weak roots, diminishing in weight and size, cannot forage for nutrients in the soil.

It seems clear that continuous grazing, even when the acreage per animal is generous, must be a poor policy. Even from a short-term point of view it severely reduces grass output; from the long-term point of view it weakens the grass roots disastrously. Modern strip grazing, controlled by the electric fence, is a much contrasted operation. It can allow the grass plants those periodic intervals of rest that are clearly so fruitful; indeed, without periods of rest there is effectively no April-September growing season—it is merely an illusion.

Nematodes

THE importance of nematodes as enemies of cultivated crops yearly receives increasing recognition. At present about 50 species are known as being truly parasitic, but doubtless many more remain to be recorded, especially from the tropics where so far relatively little attention has been paid to them. They are known to be pests of all crops in the south and warmer regions of the United States, cotton, tobacco, peanuts, maize, sweet potatoes and vegetables being most liable to attack. They do not, however, only attack the roots and other underground parts of plants, but also on occasion the above-ground parts including stems, leaves and flowers. Nor are their attacks confined to annual plants; perennials including peach, citrus and fig trees are also damaged. In general it may be said that nematodes feed on all crop plants and that plant parasitic nematodes can be found in all soils. A general account of the position in regard to nematode attacks, by Dr. B. G. Peters, appeared in WORLD CROPS, **2**, p. 11.

A striking feature in the bionomics of one of the most economically important species, the potato eelworm *Heterodera rostochiensis*, is the way in which it responds to the presence of growing potatoes in the soil. The females of the species develop, when their life cycle is complete, into cysts filled with fully-developed larvae. These hatch out of the cysts in very small numbers if there are no potatoes growing in the vicinity; if, on the other hand, living roots of potatoes are present the larvae hatch out in large numbers. It is assumed that the potato roots give out some chemical which stimulates hatching. This is usually referred to as potato root diffusate. Other solanaceous plants also give out similar diffusates which stimulate hatching.

It has been known for some time that peaches may show resistance to nematode attack, but recently three American

workers* have claimed that moderate infection by nematodes may actually stimulate the growth of peach trees. It is suggested that the nematodes themselves may show differential absorption of certain minor elements and that the accumulation of copper and iron in the leaves is reduced when the plant is inoculated with nematodes; while when growth stimulation occurs the accumulation of calcium and magnesium in the leaves is greater than where injury is recorded.

These observations are certainly intriguing and seem to suggest that there may be a peculiarly intimate relationship between nematodes and plants they infest. Further research in this connection would seem likely to be amply rewarding.

Space for science

TWO distinguished contemporaries, *Endeavour* (1952, **11**, 44, 171) and *Discovery* (1952, **13**, 10, 324), have recently discussed relationships between science and the Press. A leader in *Endeavour* regrets that although theatrical and cinema criticism and news have become regular features of the daily paper, 'scientific news has attained no comparable status, and the emoluments which pertain to it are not attractive.' The column space given to science is disproportionately small, a sadly inadequate reflection of the part that science now plays in everyday life. An article in *Discovery* by a writer who was for three years a scientific journalist on the staff of a mass-circulation weekly paper not only confirms this general background but reveals some of the causative difficulties. Many scientists withhold their co-operation. Other scientists who co-operate to the extent of writing for the Popular Press are regarded with suspicion; such efforts may still mean 'loss of caste'! So far the experiment of employing specialist science editors or correspondents in Fleet Street has not been wholly successful and the posts have been associated with long casualty lists.

How much more fortunate is our own subject, agricultural science! In so many respects agricultural science has been given a Cinderella struggle but one blessing we can count is that it has never been seriously neglected by the Press. It is, of course, an example of science in application and the simpler basic facts of agriculture are understood by many, if not by most people. Often, too, a new technical weapon for the farmer is also a weapon for the back gardener, *e.g.* the selective weedkillers for grass. Another helpful influence lies in the fact that farming is perhaps the only industry for which newspapers tend to have specialist reporters. Major papers may have their motor or aircraft industry reporters, etc., but quite a large number of provincial papers in Britain have their own farming experts. A notable reflection of this is found in the vigorous existence of the Guild of Agricultural Journalists, an organisation of considerable influence both in farming and Fleet Street. These writers, experienced in appreciating the practical farming angle and the newspaper reader's interest, have consistently given space to agricultural science and research.

One of the main problems of our time is to make sure that existing knowledge is widely utilised. Though other branches of science may find it difficult to achieve easy contact with laymen, agricultural science has been long well served by the British Press, and we believe this is also true of many other countries.

It is a happy circumstance that we are apt to take for granted.

Readability and agricultural publications

AS a corollary to what has been said in the preceding paragraphs comes the news that the Division of Fundamental Education of the Pan American Union is engaged in studies aiming at devising a system of assessing the readability of scientific publications, including those in the field of agriculture, at various levels. We have on more than one occasion stressed that, as the ultimate beneficiary of all agricultural research is the farmer, it is pretty important to ensure that at some stage of the proceedings the results of the work undertaken for his benefit, and incidentally largely financed at his expense, should be put forward in terms which he can readily comprehend.

Today the results of much scientific work are published in language only readily comprehended by the instructed. While this is no doubt unavoidable and indeed commendable from the point of view of the experts engaged in its performance, it is surely very desirable that it should, as soon as is practicable and politic, be translated into simple language readily comprehensible by the practical man. It is not only reasonable but very desirable that he should be kept currently informed concerning developments in the many lines of research that are in progress in his interests.

We learn that in the interests of readability the language experts of the Division have devised a series of formulae to enable them to assess the degree of reading facility which an article possesses. The procedure is apparently based upon the computation of the average length of sentences and the frequency index of words employed. It is claimed that this enables reading material to be tested and provides a means of preparing agricultural publications properly graded for different levels of education and intelligence.

Moreover, the compilation of an agricultural vocabulary makes it possible to determine the words which are most frequently used and understood most readily by the majority of the farmers.

It is stated that even in the United States the system is still relatively new and has only been used at all widely for the past few years. It has, however, apparently given encouraging results under American conditions. Obviously its extension to other countries must be accompanied by the compilation of similar formulae and vocabularies for the languages spoken. It does seem to hold out the prospect that in due time it may be possible to assess accurately the power of popular agricultural literature to reach the public for which it is intended and thereby to enhance materially the value of much of the research work in progress.

*Chetwood, Specht and Havis, *Plant and Soil*, 1952, p. 477.

Brown seaweeds of the type harvested from the Scottish coast

Seaweeds — A New Source of Chemicals and Food

F. H. WOODWARD, B.Sc., Ph.D., F.R.S.E.
Director, The Institute of Seaweed Research

In days gone by the collection of seaweed and the preparation of kelp for the manufacture of soda ash and iodine was an important industry in Scottish and Irish coastal areas. It decayed with lapse of time and the development of other sources of supply. Of late years, however, especially during and since the war, there has been renewed activity in this connection and an industry has developed in the collection of seaweed as a source of alginates and other material. In bringing about these developments a leading part has been played by the Institute of Seaweed Research, of which an account is given in this article.

SEAWEEDS, or marine algae, to give them their proper name, are usually classified by colour, red, brown, blue-green and green depending upon the nature of the pigment they contain: they are true plants dependent upon sunlight, carbon dioxide and the minerals potash and phosphate for their healthy growth. Unlike land plants, they have no roots but absorb their nourishment through their fronds (leaves), they nearly always grow attached to rock and a certain amount of buffeting by wave action apparently is conducive to healthy growth.

Location and varieties

A good idea of the zonation of the common seaweeds in N.W. Europe can be obtained by walking along almost any rocky shore in Britain at low water away from built-up areas whose sewage spells death to the marine plant life. The little rock pools left by the receding tide will frequently contain small red and green seaweeds. Prominent amongst the red seaweeds is *Gigartina stellata* from which agar is obtained. Between high and low water marks are usually found five different types of brown ' littoral ' seaweed varying from the small clusters of *Pelvetia canaliculata* in the splash zone, through the larger *Fucus spiralis* and the bladder wracks, *F. vesiculosus* and *Ascophyllum nodosum* down to the serrated wrack, *F. serratus*, which is hardly uncovered at low tide.

If we could walk into the sea where it has a rocky bed we would almost certainly find three distinct types of ' sub-littoral ' Laminariaceae which are bigger and unlike the littoral weeds seen on the shore as they have a smooth stalk or stipe sometimes several feet in length, surmounted by a large leaf or frond. The first type to be encountered would be *L. saccharina*, a sweet tasting plant with a crinkled leaf, lower down the ' horse-tail kelp ' *L. digitata*, and finally the robust *L. cloustoni* with a rough sturdy stipe which flourish between five and seven fathoms, beyond which seaweed growth diminishes rapidly as sunlight fails to penetrate.

Different localities and environments favour the growth of different species of plant in the sea as on the land, but this pattern is fairly typical along the coastlines of N.W. Europe, Japan, the Canadian maritime provinces, Newfoundland and the New England coast of North America.

The coastal waters of California and of Southern Peru, Chile, Southern Argentina, the Falkland Islands, New Zealand and Tristan da Cunha are different in that they support the growth of the famous buoyant ' giant kelp ' *Macrocystis pyrifera*, which is the largest plant in the world, exceeding in height even the redwood trees of California.

Use of seaweed—historical

For centuries seaweeds have been used by maritime countries either as human food, particularly in Japan, as fertilisers or as a source of chemicals. The production of inorganic chemicals from brown seaweeds is one of the oldest branches of chemical industry, having its origin as far back as 1720 when soda was first produced from kelp, *i.e.* burnt seaweed, in France, later to be taken up in Ireland, Scotland and Norway. Until the early 19th century

this was the only source of this chemical which became in increasing demand as the basic material for the glass and soap industries. When cheaper Leblanc soda became available the kelp industry was able to switch first to potash and later to iodine production. This reached sizable proportions in Scotland, and in 1820 more than 20,000 tons of kelp were produced in the Outer Hebrides, involving the collecting and burning of about a million tons of cast weed.

History repeated itself, however, in the middle of the 19th century when cheaper sources of potash and iodine were found, and by about 1870 the industry was struggling for survival. Foreseeing the end, E. C. Cortis Stanford, the chief chemist of the principal company engaged in kelp production, examined that part of the seaweed burnt during the previous 150 years in the belief that it might contain other chemicals of value to industry. As a result, he discovered alginic acid in 1883, elucidated its chemical constitution, and found it to be a colloidal material not unlike cellulose. Stanford was, however, years in advance of the times and the chemicals-from-seaweed industry virtually came to an end before the close of the 19th century.

As kelp production in the Hebrides and Orkney had been the principal means of livelihood of these islands for over a century and a half the loss of markets resulted in considerable and rapid depopulation.

Recent developments

Many efforts have been made during recent years to prevent this decline and various projects suggested to afford the crofters a livelihood sufficiently attractive to stop depopulation and, if possible, reverse the trend. One possibility was to attempt the re-establishment of an industry based on the seaweed resources, although it was obvious that any attempt to revive the production of soda, potash and iodine would not succeed. Discoveries made, however, since the demise of the old industry suggested that a new one might be based on the organic chemicals contained in seaweed, provided certain fundamental data were obtained and new techniques developed.

One of those principally responsible for the resuscitation of the industry is C. W. Bonniksen, who in 1929 reinvestigated the alginic acid discovered by Stanford 50 years earlier, and conceived the idea that it might be possible to produce cellophane-like material from it. After successful laboratory-scale experiments he and a number of his university colleagues formed a company for the purpose of collecting brown seaweed, extracting alginic acid therefrom and converting it into cellophane-like material. Despite many difficulties some success had been achieved by the late 30's, when a small factory was in operation at Bellochantuy on the Mull of Kintyre, although the outbreak of war in 1939 put a stop to the full commercial fruition of this project.

War-time developments

Early in the war it became obvious to the Service Departments that a substitute for Indian jute hessian used in camouflage production was urgently needed, and furthermore, that the basic material would have to be found in Britain and be of a type for which there was no great demand. Thanks to the work of Bonniksen and his company, seaweed was the obvious choice.

The Ministries of Supply and Home Security initiated a number of projects and investigations to develop a camouflage textile from alginic acid which it was hoped could be obtained in adequate quantities from indigenous brown seaweed. This involved the design and construction of three factories for the production of alginic acid; the responsibility of establishing and operating them was given to Bonniksen and his colleagues. At the same time, fundamental and technical investigations were carried out in several university and government laboratories and in the laboratories and works of a number of textile firms, all with the purpose of producing satisfactory alginate yarn and subsequently fabricating from it a textile suitable for camouflage purposes.

Success followed these efforts, although by the time a satisfactory textile became available the need for it had decreased, as the Japanese were then being pushed back and their threat to the Indian jute supplies minimised.

Postwar development

As the outcome of this work three large and well-equipped factories were established on the west coast of Scotland, but once the wartime demand for alginate fabrics lapsed the risk arose that the new industry would, after all, fail to become permanent. Wartime investigations had revealed many gaps in our knowledge: little was known, for example, about the location and availability of the brown seaweeds growing in Scottish inshore waters, and next to nothing about the composition of even the most common species, while no methods for mechanically harvesting the sub-littoral brown algae had been developed.

The Institute of Seaweed Research

The Scottish Seaweed Research Association (now known as the Institute of Seaweed Research) was therefore formed towards the end of 1944 at the instigation of a number of Government Departments and other organisations interested in seaweed utilisation, with a view to providing basic information on which it was hoped that non-governmental interests could build an industry based on Scottish seaweed, primarily with a view to bringing useful employment to the crofter population of the Scottish highlands and islands.

The broad line of attack followed by the Institute staff and their collaborators has been the determination of the location and quantities of the more prolific seaweed beds and the effect of environment, species, season, etc., on the chemical composition of the common species. The chemical and physical properties of the principal algal chemicals have been studied, methods for their extraction developed and assessed on the commercial scale, and where possible industrial outlets found for them. Methods for the mechanical harvesting of the under-water species have also been developed.

Seaweed resources

Until recently, few attempts had been made to survey the seaweed-bearing areas of the world; partly due to lack of interest and partly on account of the difficulty of assessing accurately the non-buoyant types

The introduction of aerial photography of the sea bed has saved years of laborious boat work

which are usually invisible from the surface of the sea or from the air.

During and since the war the position has improved as surveys and assessments of varying accuracy have been made of certain red weed-bearing areas in Britain, U.S.A., Canada, Australia, New Zealand and South Africa, and of the brown seaweed resources of Scotland, British Columbia, the North American Pacific coast, the Falkland Islands, and New Zealand.

With the exception of Scotland all the latter areas were fairly easily surveyed as the principal seaweed growing there was Macrocystitis, the fronds of which float on the surface of the sea, and the assessment of a given area was relatively easily made by aerial photography or by surveying from a boat.

The Seaweed Research Institute maintains a small fleet of boats which cut and collect weeds at the rate of over a ton an hour

Survey methods in Scotland

In Scotland, where the bulk of Britain's seaweed is found, the problems were many and difficult.

A reasonably clear idea of the location of the principal beds had first to be obtained. This was not easy, but examination of Admiralty charts eliminated areas with sandy or muddy seabeds, which will not grow seaweed. The next step was to find beaches on which sub-littoral weeds were thrown up by winter storms. This necessitated weekly observations during two winters of over 30 beaches, mostly in Orkney, the Hebrides, and the Scottish west coast. As a result it was found that the inshore waters of the Orkneys and South Uist in the Hebrides probably support a bigger growth of the Laminariales than any other area off the coast of Britain,

Examining submerged seaweed through a view box

and the first serious attempt to determine the quantities and types of submerged seaweed was consequently centred on the Orkney Islands.

The limits of the beds in this area as seen from an aeroplane were sketched on charts, and the task of estimating tonnages and types of seaweed begun. A survey boat examined the submerged seaweed through a view box, and having decided that the bed contained sufficient seaweed of the right type and defined its limits, the task of assessing the growth density commenced. This was done by sampling the bed with a specially designed grab over half-square yard areas at intervals, each sample being hauled up, weighed and subdivided into the various types of weed present. By this means the entire bed was covered and the resulting data, when plotted on a map and analysed statistically, enabled an exact estimate to be made of the amount and type of weed growing in it.

This work was carried on for over two years in Orkney, during which time the grab was lowered and raised over 20,000 times. It was found that between low-water mark and seven fathoms in the Orkneys there were 1,250,000 tons of seaweed growing.

Aerial survey methods

While this work was in progress efforts were made in collaboration with the R.A.F. to develop an easier method of survey based on aerial photography. During the war improved photographic techniques had been devised which enabled the sea bed to be photographed in detail from fast-moving planes flying reasonably high, and it was found that these techniques could be modified to record in detail submerged seaweed beds in inshore waters. This was a tremendous step forward and eventually saved years of laborious and expensive boat work, for as soon as the coastal areas had been photographed most of the initial survey work could be carried out on the profiles so obtained with relatively few random boat samplings.

Although the survey of the Scottish seaweed beds is not yet complete, sufficient has been done to indicate that the 4,500 miles of Scottish coastal waters contain total seaweed resources of about 10,000,000 tons, equivalent to a potential annual harvest of about 1,000,000 tons of seaweed when allowance has been made for inaccessible beds and a four-year recovery period.

Although no surveys as accurate as this have been made elsewhere, sufficient has been done to be certain that there are at least 60 million tons of seaweed growing along the coastlines of Norway, France, the British Isles, Canada and the U.S.A., and the Falkland Islands.

Seaweed harvesting

The old kelp industry depended upon seaweed thrown up after winter storms, and its collection by hand was, at best, a hazardous and unpleasant occupation. This method is still employed in Ireland, Norway, the Scottish Outer Hebrides, and Brittany, although it is realised that if the industry is to expand mechanical methods of harvesting must be developed. Considerable progress has already been made by the engineers of the Institute of Seaweed Research and the day may not be far off when seaweed-collecting boats will become as common a sight as fishing boats in our coastal waters.

The problems which had to be solved were, however, among the most difficult which marine engineers have had to face, since the underwater algae, besides being invisible from a boat and heavier than water, must have rock on which to grow, and only grow in relatively shallow water; where even on calm days in North Britain the swell is sufficiently great to make inshore operations hazardous.

Despite this, two methods have been worked out, both of which have been proved to be mechanically feasible. The first and easiest consists of towing a specially designed grapnel along the sea bed behind a small fishing boat; the most recent types can bring up a quarter of a ton of seaweed per drag. The second method, which is more highly mechanised and capable of landing larger catches, is based

upon the principle of the common dredge with the dredge buckets replaced by rows of hooks which, after having torn the weed off the rocks on the sea bed, throw it into the hold of the harvesting vessel.

A third method which is undergoing trial and which perhaps shows even greater promise is essentially a combined lawn mower and vacuum cleaner dragged over the sea bed from the stern of the harvesting vessel. These last two methods look as if they may have solved the problem of supplying living brown seaweed at an economic price and in a constant quantity and quality to the small but rapidly growing industry.

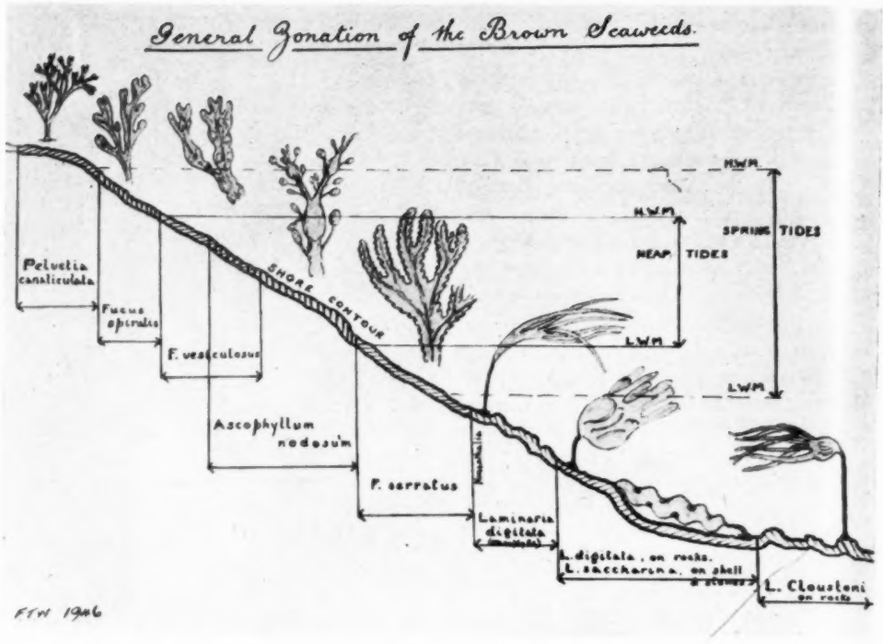
Organic seaweed chemicals

Recent chemical studies have shown that these marine plants resemble land crops such as cereals, maize, rice and timber in that they are made up primarily of carbohydrates, proteins and minerals with the pigments, vitamins and sterols necessary for healthy growth present in small amounts. The biggest chemical difference between land and sea plants lies in the individual constituents and the variation in seasonal contents.

Land plants, in general, owe their strength and rigidity to the presence of cellulose; in the brown seaweeds, on the other hand, this function is taken over by alginic acid, the raw material of the wartime camouflage textiles. The reserve food of land plants is starch, that of marine plants a similar but not identical compound named laminarin, whilst the place of sugar is taken by mannitol. The first two of these algal compounds are unique since they are found nowhere else in the world; the third, mannitol, can be manufactured from cane sugar by electrolytic hydrogenation, but is not generally available outside America. In other words, there could be made available each year, as soon as economic seaweed harvesters have been devised and come into operation, millions of tons of these chemicals: Scotland alone is capable of providing each year the raw material for the manufacture of between 70,000 and 110,000 tons of carbohydrates depending upon the time of the year at which harvesting is undertaken.

Alginic acid and alginates

Largely as the outcome of the British wartime use of alginic acid, the remarkable properties of this compound have become better understood and it now has an assured place in the world chemical market. Something like 200,000 tons of seaweed are annually converted into alginates in Britain, America, Norway and France, and the acid and its better-known derivatives find outlets in a wide range of commodities varying from sauce and soup thickeners, ice cream stabilisers, etc., to moulding compositions for taking dental impressions.



Each seaweed variety has its own depth for optimum growth

Perhaps the most spectacular use is the production of soluble alginate yarns which are used as scaffolding in the manufacture of ultra lightweight wool fabrics. Having served its purpose as a strengthener of the fine woollen yarn during the weaving process, the alginate is dissolved out and the remaining fabric, although as light as silk, has all the warmth and pleasant feel of a woollen fabric.

Less spectacular but perhaps more important are the uses now being developed for alginates in surgery and medical practice. It has been found that alginates are ideal carriers of penicillin and bone-healing hormones and, being readily absorbed and haemostatic, can be used as soluble ligatures and to plug internal lesions to prevent bleeding; after having achieved its purpose the alginate plug or ligature, being soluble, dissolves with the wound. Burns may also be treated by covering with a film of alginate, the protective film can subsequently be removed without discomfort.

Of the other chemicals found in the brown seaweeds only one, mannitol, has so far found industrial application. It is employed in the manufacture of detonators, fancy papers and certain pharmaceuticals, and in the production of synthetic resins.

The remaining seaweed chemicals are so new that it is impossible to foresee the uses which may be found for them, although there are already indications that laminarin can be used as a substitute for blood plasma, and as a source of the energising sugar, glucose.

The red seaweeds

Less is known about the chemistry of the red seaweeds which are unlike the more abundant brown algae in appearance, habitat and constitution. As far as is known they do not contain any of the chemicals found in the brown weeds, although they do contain certain starch-like compounds which have already found many useful outlets in industry; principal amongst these is agar-agar.

This material, well known for its jelly-like properties, was made, used and exported in great quantities by Japan prior to the war. Its best known use is as a microbiological testing medium. When penicillin production was stepped up during the war, agar was required in considerable quantities, and as Japanese supplies were no longer available many of the Allied countries took steps to produce agar from red weed grown on their own shores. In this way during the course of a few months Great Britain, America, Australia, New Zealand and South Africa all built up reserves of this material, and as a result agar industries in most of these countries have been maintained. Agar-agar, although not as widely used as its brown seaweed counterpart alginic acid, finds uses in a variety of ways. In addition to being a mild laxative it is employed by the confectionery, bakery and cosmetic

trades and is finding increasing use by meat packers.

Seaweed as stock food

Although many reports have been published on the feeding of seaweed for livestock, the results have been of a contradictory nature. Few controlled digestibility trials have been carried out and considerable doubts still exists as to the nutritive value of any but the most common species. One reason is that it has only recently been realised that the many species of seaweed each undergo considerable seasonal variation in chemical composition, and that just as with land crops, there are optimum seasons for harvesting.

Sufficient has been done, however, to show that although in islands like the Orkneys and Iceland sheep can live entirely on brown seaweed for the greater part of the year, marine algae in general cannot be regarded as a basic food; partly because the apparent protein content is low (4-15%) and partly because certain of the ingredients under this head are indigestible.

As supplementary feeds, however, they have a definite value. Their carbohydrate content is high as is the digestibility of these components; in addition, seaweeds compare with green vegetables in their vitamin content, while they also contain all the trace elements that have so far been shown to play an important part in the physiological processes of livestock.

Such investigations as have been carried out appear to show that pigs, cows, sheep, poultry and ducks can eat brown seaweeds as an added food without harm. These trials have shown that animals on a seaweed diet thrive as well as do the controls and no adverse effects have been noticed on their flesh, milk or eggs, provided that only seaweeds having reasonably low ash (⩾20%), iodine and fibre contents are added to the normal diet in amounts not exceeding 15%.

At present factories producing blended seaweed meals for livestock rations are known to be operating at San Pedro, California, U.S.A.; Kilrush, Eire; Nairn, Scotland; Kristiansund, Norway; Cape Finistere, France; as well as in Germany, Holland and Japan.

Obviously a long time must elapse before mariculture can compete successfully with agriculture, but the advances made during the post-war years have shown that the marine flora can be and are being used to help to reduce world shortages of raw material.

Photos: Pp. 403 and 405 (left), Central Office of Information; p. 405 (centre), The Scottish Field.

Bananas and Manila Hemp

N. W. SIMMONDS, M.A., A.I.C.T.A., F.L.S.

Senior Cytogeneticist, Banana Research Scheme, Imperial College of Tropical Agriculture, Trinidad, B.W.I.

The characteristics and properties of the group of plants that are classified with the bananas are varied and striking. Of late years the production of types resistant to various diseases has assumed prominence. This aspect was dealt with in an article which appeared in* WORLD CROPS *some time ago (Vol. 2, p. 56). In the following article the author discusses certain aspects of this important group of plants and the possibilities of its further development.

A RIPE banana and a hempen rope are very different products, yet they come from quite similar and closely related plants. It is only recently that the bananas have become sufficiently well understood to permit an account to be given of the botanical background to their economic characters. However, studies carried out over the last 20-odd years by Prof. E. E. Cheeseman on living collections at the Imperial College of Tropical Agriculture in Trinidad have resolved most of the major systematic difficulties and permit a fairly coherent account to be given of the economic botany of the bananas as a whole.

Wild bananas

The cultivated edible bananas are genetically far removed from their wild ancestors; on the other hand Manila hemp is still virtually a wild species. To understand the edible banana it is, in fact, necessary to concentrate on its wild relatives. They are all plants ranging in height from 3 to 40 ft. possessing pseudostems built up from leaf-sheaths through which the true stem, bearing its terminal inflorescence, pushes its way. They all have certain floral characters in common; their fruits for example are usually filled with hard black seeds. The natural habitats of most of them are the more open places in moist tropical forests, ranging in altitude from sea level up to several thousand feet.

Genera and species

The various genera and species fall naturally into five groups based on chromosome numbers and systematic characters as shown below.

Manila hemp

The genus *Ensete* and the section *Callimusa* of the genus *Musa* are of negligible economic significance, though *Ensete edule* yields a fibre which is of some importance in Abyssinia and Kenya, and *Musa coccinea* is of minor importance as an ornamental plant.

The section *Australimusa* is important since it contains Abaca or Manila hemp, *Musa textilis*, which is of prime importance as a source of marine cordage and also yields a useful textile in the Philippines. Until the late war this fibre, which is extracted from the leaf sheaths, was virtually a monopoly of the Philippine Islands where it was produced largely by Japanese farmers using hand labour for extraction—an inefficient process and a very exhausting one for the labourers. The war and subsequent political disturbances have, however, greatly reduced the Philippine industry, while, concurrently, estate production of the crop in Central America under the aegis

GENERA AND SPECIES OF THE BANANA/MANILA HEMP GROUP

Genus	*Basic Chromosome Number*	*Section*	*Economic Products*
ENSETE (Mainly African)	9		A minor fibre in East Africa.
MUSA (Mainly S.E. Asian)	10	*Callimusa*	One ornamental plant.
		Australimusa	Manila hemp and a minor edible banana.
	11	*Rhodochlamys*	Some are ornamental.
		Eumusa	The great majority of edible bananas and a minor fibre.

of the U.S. Government has developed on a considerable scale. Nearly a quarter of a million acres are now said to be cultivated, and production and processing are highly mechanised.

The few edible bananas in the section *Australimusa* are rather mysterious plants of the Pacific islands, which include the well-known *Musa fehi*. They are of negligible economic importance compared with the edible Eumusas, but they do serve to illustrate the important point that the quality of edibility in bananas has more than one origin in the genus as a whole.

Rhodochlamys

The section Rhodochlamys includes some very attractive little plants with gaily-coloured pink, violet or scarlet bracts, but they have no economic importance apart from some slight use as ornamentals —*Musa ornata* and *Musa sanguinea*, known in some tropical gardens and temperate greenhouses, belong to this section. Another species is *Musa velutina*, a native of Assam, which incidentally has the distinction of being the only known 'self-peeling' banana—when ripe the pink hairy skins of the fruit split along three lines and curl back exposing the central mass of seeds and pulp.

The Section Eumusa

The great majority of the edible bananas have, however, originated from Eumusa, in particular from two wild species, *Musa balbisiana* and *Musa acuminata*, which extend geographically from India to the Philippines and New Guinea. The species *Musa basjoo*, indigenous to the Liu-kiu archipelago, yields a fibre from which the Japanese make (or used to make) a cloth called 'bashofu.'

Edible Eumusas

The extraordinary range of variation shown by the edible Eumusas is due to a number of factors; two wild species are involved, both separately and jointly as hybrids, which are themselves variable, *Musa acuminata* extremely so; polyploidy is also involved since the wild forms and some cultivated forms are diploid ($2n = 22$) while many other cultivated forms are triploid ($2n = 3x = 33$); in addition many varieties are very old and have, in the course of a long clonal existence, thrown off numerous mutations or bud sports. Furthermore, it is just possible that other wild species, at present unrecognised, have played a part in the origin of the edible Eumusas.

Parthenocarpy

The distinctive character of the edible banana fruit, *e.g.* the absence of seed,

The fruit of a synthesised parthenocarpic type; it is full of edible pulp and contains no seeds. This fruit was taken from one of the new male parents shown on the opposite page

The fruit of a wild *Musa acuminata* showing its short, plump shape and numerous black seeds embedded in pulp. The seeds contain an embryo and white floury endosperm clearly visible in the sectioned fruit

referred to botanically as parthenocarpy, has received considerable study in recent years. It appears that it is caused by the production or liberation in the fruit of plant growth substances (hormones) which cause the development of sweet edible pulp but inhibit the development of seeds. These are under genetic control and the whole physiological and genetical system of parthenocarpy has been shown to be quite complex; evidently a long period of human selection for desirable fruit characters has occurred.

It is not known exactly how many varieties of banana there are; probably there are several hundred distinct forms and certainly there are very many hundreds of varietal names. Broadly speaking, *Musa balbisiana* and some hybrids have given rise to the cooking bananas, and *Musa acuminata* to dessert bananas, but the distinction is by no means sharp and there are enormous differences in local practices and customs. The name *plantain* is often applied indiscriminately to cooking bananas, but this gives rise to untold confusion and it is probably better to restrict the word to a certain group of varieties of *Musa acuminata* which have rather starchy ripe fruits and are, in fact, normally cooked before eating.

Economic significance

The economic significance of the crop is enormous. The banana is an important garden plant throughout the tropics. It must have originated in the East (perhaps in Malaya as a primary centre) some thousands of years ago. It was introduced to East Africa many hundreds of years ago and it became something it never was in its native countries—a *staple* foodstuff, and has remained so to this day, though its importance in this region is declining as maize, sweet potatoes and cassava replace it. The development of the crop as a valuable export from tropical plantations to temperate markets originated in the New World. From simple beginnings in Jamaica in 1870, the trade has developed into a vast and complex undertaking involving an elaborate organisation of railways, roads, irrigation, spraying and shipping. The main growing areas are in tropical Central and South America, the West Indies (especially Jamaica and the French Antilles) and West Africa. The most important variety is the Gros Michel, which is especially well adapted to refrigerated storage aboard ships. It is grown mainly around the Caribbean and in West Africa. The Dwarf Cavendish, Chinese or Canary banana is the basis of valuable minor export industries in the Canary Islands, Brazil and Queensland. The Gros Michel variety is declining in importance on account of its susceptibility to Banana Wilt or Panama Disease (*Fusarium oxysporum* var. *cubensi*), and in the last 20 years or so other varieties (related to the Dwarf Cavendish banana) have been replacing it, especially in the West Indies. These varieties are resistant to Wilt but are very susceptible to Sigatoka or Leaf Spot disease (*Microsphaerilla musicarla*) and also have certain other undesirable features. The solution lies ultimately with the banana breeder and considerable progress is being made in the production of new and resistant varieties.

Banana breeding

Banana breeding started nearly 30 years ago at the Imperial College of Tropical Agriculture, and with it went the botanical studies which have revolutionised our understanding of the genus. The practical problem was narrowed down by the following considerations: (1) All desirable bananas suitable for an export trade are related to *Musa acuminata*, therefore in breeding work the employment of this species is indicated. (2) Of the existing recognised desirable types, Gros Michel is undoubtedly the best and, moreover, it is slightly seed-fertile if pollinated. Members of the Cavendish complex, however, are less desirable and in any case are highly seed sterile. On this account the Gros Michel variety is the obvious choice for use in breeding work. (3) Many edible varieties —Gros Michel among them—are male sterile triploids which, by female restitution, produce tetraploids as seedlings if pollinated by normal haploid pollen. These primary tetraploids, as Dodds has called them, are normally vigorous, though their progeny (secondary polyploids) for various genetical and cytological reasons, are undesirable. Therefore the aim should be to produce a desirable tetraploid from Gros Michel in one step and, in this case, success obviously depends on the choice of male parent. (4) Diploid *Musa acuminata* varies enormously, therefore the process of male parent breeding depends on having a large collection of different types to work on and, in fact, a very fair collection has been assembled at the Imperial College of Tropical Agriculture over the years.

Some early crosses of Gros Michel with quite crude unbred bananas as male parents were surprisingly nearly successful and, indeed, one of them, the I.C.2 banana, is actually in small-scale commercial use in Honduras. Later progress has been slow, largely because of the limited amount of diploid *acuminata* material available. Better male parents have in fact been in use for the past ten years, and some of their progeny are now in the late stages of testing; it is fair to say that, subject to the result of final tests, the best of them seem to be very good. New male parents are continually being produced and the prospects for their performance seem, on the whole, to be highly promising. We may accordingly reasonably hope to see a number of new disease-resistant banana varieties in commercial production in the next few years.

Conclusion

Of the great wealth of variation in this extraordinary genus *Musa*, only a minute fraction has so far been put to large-scale commercial use, *i.e.* one wild species, *Musa textilis*, as a fibre and a few clones of *Musa acuminata* as edible bananas. Some of the variation is probably useless to the plant breeder, but it cannot be doubted that the thorough exploitation of the rest might lead to great agricultural advances. Manila hemp, for example, is seriously attacked by several virus diseases and yet we have not identified botanically all the wild species related to it in the section *Australimusas*—let alone all the varieties within the various species. It may, in fact, be said that banana breeding has only just begun.

A bunch of one of the new male parents. Notice the long, shapely, erect fruits and, below, the male bud from which pollen-bearing flowers are taken to pollinate the Gros Michel banana

One of the products: a fine bunch of one of the new bananas, actually a tetraploid hybrid of Gros Michel by a parthenocarpic male parent. This photograph was taken in a field trial in Jamaica where the plant was bred

Photos: Pp. 408 and 409 (bottom), Imperial College of Tropical Agriculture; p. 409 (top), N. W. Simmonds.

Royal Patronage

Her Majesty The Queen has granted her Patronage to the Imperial College of Tropical Agriculture, Trinidad.

The college was first honoured in this way by King George V, who granted his Patronage in March 1927. King Edward VIII became Patron in May 1936 and King George VI in February 1937.

New Royal Show Director

Following the resignation of Mr. Michael Mason as Honorary Director of the Royal Show, Lt.-Col. Guy Blewitt has agreed to take over direction of the Show for 1953.

Mr. Mason has been Honorary Director of the Royal Show since August 1950, and directed the shows at Cambridge and Newton Abbot.

Col. Blewitt has been a member of the R.A.S.E. Council since 1939. From 1947 onwards he has been Steward of the Grand Ring, and for many years Chairman of the Stock Prizes Committee.

Argentine Tobacco

Tobacco cultivation in the Argentine Republic dates back many years and has gradually developed until today the country is self-sufficient. Most types of tobacco are grown, principally in the northern part of the country, Corrientes, Salta and Jujug.

The following table is supplied by the Argentine Chamber of Commerce in London.

TOBACCO ACREAGE AND PRODUCTION IN ARGENTINA, 1937-8—1950-1

Year	Area Harvested (1,000 of) hectares)	Production (1,000 of tons)
1937-38	9.4	7.8
1938-39	17.3	20.3
1939-40	19.4	18.6
1940-41	17.6	18.0
1941-42	14.3	14.8
1942-43	15.6	18.0
1943-44	18.6	19.1
1944-45	18.9	21.1
1945-46	24.3	29.2
1946-47	25.8	26.6
1947-48	20.4	20.5
1948-49	23.9	26.4
1949-50	24.4	27.3
1950-51	24.2	35.0

Decline of Plantation Agriculture in Indonesia

JOHN E. METCALF

Regional Specialist, Far East Division, Regional Investigations Branch, OFAR, U.S. Dept. of Agriculture

Changing conditions in a changing world are having their effect on production patterns. Indonesia under Dutch control was remarkable for having almost attained self-sufficiency in foodstuffs, combined with being the largest exporter of plantation produce. Now in its new-found independence the Republic of Indonesia is laying primary emphasis on producing sufficient food to feed its rapidly growing population, and in consequence export production of many staples is declining. The position is reviewed in the following article extracted from the official American publication, 'Foreign Agriculture.'

INDONESIA has long been unique among the countries of South-East Asia because of the strong dual nature of its agrarian economy—on the one hand, a fairly self-contained peasant economy producing food crops primarily for personal consumption; on the other hand, a highly developed and well-diversified plantation industry supplying world markets with great quantities of tropical agricultural products. In the years just prior to the Second World War more than 2,400 privately operated plantations (predominantly Dutch in management) exported about 35% of the palm oil entering world trade, 30% of the sisal fibre, 90% of the cinchona (from which quinine is extracted), 15% of the tea, 5% of the coffee, 10% of the cane sugar, 10% of the leaf tobacco, and 20% of the natural rubber. In addition, Indonesian smallholders produced another 15% of the world's rubber supply, about 75% of the kapok, 85% of the black pepper, and 30% of the copra. Among the countries importing these products, the United States has for many years been second only to the Netherlands.

Post-war disturbances

During the past six years the world has waited for the revival of large-scale plantation exports from the Indies. But economic recovery from the effects of the Japanese military occupation has been delayed by a succession of other disruptive factors—the forceful return of the Dutch after the war, the lengthy 'police action' carried out by the Dutch Army, the final granting of independence to Indonesia in December of 1949, and the subsequent civil strife as the Republican Government has attempted to extend its hegemony throughout the archipelago.

This lack of domestic tranquillity, which has characterised the post-war scene, has had a most serious effect on the export trade of the islands. During 1951 agricultural exports, which currently account for about 70% of the value of all Indonesian exports, only reached one-half the tonnage averaged during the pre-war period 1935-39.

Many people assume that once the new government restores law and order, quiets labour unrest, and guarantees the protection of private property, the plantations will soon be able to increase output to a level approximating their pre-war position. Then, so the assumption goes, the West will once again be able to import from these islands substantial quantities of palm oil, Java coffee, cane sugar, the famous Deli cigar wrapper, tapioca products, and cordage fibres. However, there are several important factors that are overlooked in this optimistic appraisal of the situation.

Long-run trend

The long-run trend in agricultural exports from Indonesia has been unmistakably in the direction of a decreasing share for the plantation sector of the economy. This has resulted from the gradual awakening of the peasant farmer to the possibilities of producing for the export market. The hard task of pioneering was done by the plantations. European planters were the first to introduce many of the present commercial crops cultivated in Indonesia—rubber from the Amazon Basin, tobacco from South America, the oil palm from tropical West Africa, coffee from the Belgian Congo, cacao from Brazil, and tea from China, India, and Japan.

Protracted scientific research produced new varieties of these plants suited to local climate and soil. Costly experimentation developed better methods of cultivation. Through the pre-war extension service of the Colonial Government's Department of Agriculture the knowledge derived from this specialised experience was disseminated to the benefit of rural areas. It took hold slowly, but with each succeeding year more peasant farmers planted commercial crops as well as their traditional rice, cassava, and sweet potatoes.

At the turn of the century the large European-operated plantations produced 90% of the value of all agricultural exports from Indonesia. By the beginning of the First World War the smallholders had increased their share from one-tenth to one-quarter, and during the ten-year period after 1925 their share averaged about one-third. In the few years just before the Second World War peasant cultivators furnished about 40% of the value of all agricultural exports, and the plantations 60%. In 1948, the first post-war year during which a fair volume of exports was achieved, the pre-war relationship was reversed, and smallholders produced about 60% of the value of all agricultural exports. In 1949 their share dropped to one-half, but during 1950 and 1951 it was more than two-thirds.

Thus we observe that the trend is clearly in the direction of a gradually diminishing importance for plantation agriculture. It is true, however, that the normal movement of this trend has been accelerated by the temporary factors outlined above—factors that have had a more disruptive influence on plantation agriculture than on smallholders' cultivation. But there is a second group of factors now operating to contract the scope of plantation agriculture in Indonesia—factors having little to do with the pre-war secular trend or temporary post-war disorders.

Post-war food shortage

By far the most important consideration in a contemporary analysis of the Indonesian agrarian situation is the central problem of a food shortage. Continually increasing population, coupled with accelerated urbanisation, is putting heavy pressure on the available food supply. In addition, the levelling influence of post-war

Plucking tea on a 600-acre estate near Bandoeng, Java

Three-year-old rubber trees in Sumatra

Typical coffee plantation on Sumatra's east coast

income redistribution, expanded monetary demand, and emotional nationalism are creating an increased measure of dissatisfaction with the present shortage of food staples. Although just before the recent war Indonesia had achieved a precarious internal balance of food supply and demand, it has been importing a larger amount of rice in each post-war year—117,000 metric tons during 1947, 358,000 tons in 1949 and about 450,000 tons of milled rice during 1951.

Plantation agriculture in Indonesia has taken two distinct forms; the hill cultures, which are perennial crops (coffee, tea, cacao, cinchona, oil palm and rubber) grown on upland terrain obtained primarily by long leasehold from the government; and the field crops (sugar, tobacco, tapioca and, to some extent, cordage fibres), which are cultivated on arable lowland fields generally rented for shorter periods of time. It now appears that both government policy and public sentiment regard with increasing disfavour the use of present or potential cropland for cultivation of commercial export crops.

During the war-time occupation the Japanese deliberately settled native farmers on some of the plantations in order to obtain greater food production for the local population. Both during and since the war squatters have occupied large areas temporarily uncultivated by plantation enterprises. At present the Republican Government is initiating a large-scale programme of land redistribution designed to bring under cultivation by peasant farmers much of the arable crop land held in reserve by the various plantation enterprises.

Outlook

A study of 1950 export statistics reveals the significance of these events. Whereas 1950 plantation exports of the six principal hill culture crops mentioned above totalled 57% by volume of their 1938 level, plantation exports of the four field crops only reached 6% of the volume achieved during 1938. The return of domestic stability will undoubtedly permit some improvement over the 1950 situation in both categories, but this improvement will be achieved through more efficient production rather than any significant increase in the reduced acreage now devoted to them. It seems extremely unlikely that any of the four field crops—sugar, tobacco, tapioca and sisal—will again achieve in Indoniesia the importance held before the war.

As for the hill cultures, it seems probable that an increasing proportion of some—coffee, tea and rubber, for example—will be grown by smallholders. Indeed, this trend is quite apparent in the case of rubber, where only 25% of current production is being marketed by plantations. Other crops, such as the oil palm, cinchona and cacao require either too much capital investment or over-complicated methods of propagation to be at present adaptable to small-scale cultivation. However, cacao has never been of much importance in the Indonesian economy and synthetic anti-malaria drugs are reducing the importance of quinine on the world market.

Plantation agriculture in Indonesia, as well as smallholders' cultivation, has in the past been centred on the island of Sumatra and densely populated Java. The government's ambitious colonisation schemes should serve eventually to open up new areas for cultivation in the other islands of the archipelago, though there are many difficulties to be overcome before any significant population transfer can be achieved. In terms of the forseeable future, it seems unlikely that foreign capital could be attracted in sufficient amounts to develop any of these new areas for plantation agriculture. And the Indonesian Government is at present too concerned with the domestic food supply to serve as the financial sponsor for any such export projects.

A corner of an Indonesian palm oil estate

Photos: Indonesian Embassy, London.

Disappointing Cocoa Results

A. K. Briant, Director of Agriculture for Zanzibar, reports that disappointing but informative experience in the establishment of cocoa in the field at Kizimbani and Selem during the last five years has resulted in a clear conclusion that cocoa can only be successfully established under relatively heavy shade. Furthermore, good initial growth can be completely spoiled if the shade fails after some years or if permanent shade is not provided by the time the cocoa grows too large for protection by temporary shade. The need for dense windbreaks is also abundantly clear from experience in the field. Since the vuli season last year every effort is being made to supply temporary and, more particularly, permanent shade to the cocoa in all areas under the Department's control and to urge private planters to do likewise.

Antestia Bugs in Kenya

Information recently received indicates that with the co-operation of the Jacaranda Coffee Research Station in that territory, trials have been carried out on the control of Antestia bugs on coffee by dusting with finely-ground pyrethrum using a 'Whirlwind' duster. The trials are reported to have been completely successful, the Antestia population having been reduced, as the result of the application, from an average of 68 per bush to four per bush over the experimental area. The pyrethrum was applied at the rate of 20 lb. per acre and it was found that the machine could cover 14 rows of coffee at a time.

Antestia bugs are major pests of Arabian coffee in East Africa, especially in Kenya and Uganda. Two species exist, *viz.: A. facet* and *A. lineaticollis*. They feed on the berries, buds, leaves and green twigs of the coffee bush, but green berries are preferred food and when attacked they become infested with fungal rots. Other injuries include the dropping of berries, scarring and distortion of leaves and non-setting of flowers. The eggs of the bug are laid on the leaves of the plant and the whole life cycle is passed on the coffee bush.

Proposed Dingo Control in Queensland

In a report on major development projects in Australia, prepared by the Regional Development Division of the Australian Ministry of National Development last November, it is stated that proposals are being considered by the Queensland-British Food Corporation to control the dingo menace by enclosing existing and potential sheep areas with dingo-proof fences. This scheme would include the continuation of the western barrier of the proposed enclosure along the Queensland-Northern Territory border to the Gulf of Carpentaria.

The estimated cost, using Australian materials, is £600,000.

Australian Rice Potentialities

Australia may become one of the world's largest rice-producing countries if tests now going on in the Northern Territory are successful. It is estimated that there are 1,500 000 acres of excellent rice land within 70 miles of Darwin, all of which is watered naturally by the annual monsoons. Tests present more of an engineering than an agricultural problem, main study being to harness and control the flow of water on the flood plains.

Two areas are being developed as rice projects. These are at Humpty Doo station, 40 miles from Darwin, and at Marrakai, 60 miles away.

Commonwealth Products Map

An attractive map of the world in six colours, setting out in graphic form the natural resources and manufactured products of the Commonwealth of Nations, has just been published by H.M. Stationery Office. It shows that nearly every type of raw material can be obtained from some part of the Commonwealth; it shows, too, that the Commonwealth countries are not self-sufficient, but that there is a continual need for the exchange of products both within the Commonwealth and with other countries. A bar chart is included to bring home the vital position held by the Commonwealth as a major world supplier of certain basic raw materials.

The Organisation and Work of the Forest Research Institute of Sweden

Forestry in Sweden is the leading industry and the advances which have been made there in the scientific management of forests is recognised throughout the world. The work of the Swedish Forestry Research Institute is world famous and accordingly considerable interest attaches to the following account of the work of this organisation which has been compiled from published papers by Professor Naslund, Director of the Institute, and others, some of which were presented to the Seventh International Botanical Congress held in Stockholm in 1950.

SWEDEN, like her two neighbours Norway and Finland, is pre-eminently a land of forests. Of the total land area—410,600 sq. km.—some 231,800 sq. km. or 56% consists of forest. Owing to Sweden's considerable length from north to south the nature of the forests varies considerably in different parts of the country. Practically the whole is dominated by conifers consisting either of unmixed stands of pine (*Pinus silvestris*) or spruce (*Picea abies*) or of mixed stands of these two forms with some birch (*Betula verrucosa* and *B. pubescens*), the most commonly occurring form of hardwood. In the southern part of the country stands of rarer hardwoods, principally beech (*Fagus silvatica*), are also found.

The exploitation of the natural forest resources has proceeded without interruption for nearly 100 years but is now nearing its end because the last remnants of the primaeval forests in northern Sweden, where exploitation began later than elsewhere, have been almost entirely cleared. To ensure a supply of raw materials for the forest industries it has now become necessary to build up a productive forestry.

Virgin spruce forest, South Sweden

The conversion from an exploitative to a productive basis began some decades back, but much still remains to be done before forest utilisation is fully efficient. Increased knowledge can only be gained by extensive research. Forestry research is, however, not free from difficulty, due in no small measure to the long period of growth. Furthermore, Swedish forestry is marked by a special characteristic, namely, that the yield of wood is reduced periodically by thinning during the greater part of the life of the stand.

Under Swedish conditions, a period of 80 to 100 years or more usually elapses between the initial establishment of a stand and final cutting; it is only possible at the latter time to survey the total yield and to judge the effect of the forestry programme. Forestry research therefore becomes complicated, because, unlike agricultural research, it does not allow much scope for personal experience and observation.

During the last few decades there have been important developments in Swedish forestry, particularly in relation to the introduction of more intensive forms of forest management; this has been largely the outcome of the extensive developments which have occurred in the organisation for forestry research, and in the following paragraphs some account is given of the Swedish Forestry Research Institute and its work to which many of the advances recorded are attributable.

The Forest Research Institute

The Forest Research Institute of Sweden was founded in 1902, and from a rather modest beginning has grown to its present size.

It has two main functions. One is to ascertain how the forests can be most suitably managed, and the other is to maintain an inventory of the country's forest resources and the changes occurring therein. To fulfil these the Institute is organised in six divisions: forest management, forest surveys, forest education, botany and soils, genetics, and zoology; in addition, there is a department of statistics.

Research is based primarily on the analysis and study of experimental data collected in field surveys. The field work is very extensive and there are over 1,000 experimental plots and temporary investigation plots scattered over the country. In addition, the Institute has at its disposition four experimental forests with a total area of 3,400 hectares (about 8,160 acres) of forest land, as well as a genetics experiment field of about 500 hectares (1,200 acres).

The aim of the experimental parks is twofold: (*a*) to concentrate experiments in a carefully selected area and (*b*) to study measures for forest conservation and their application on a large scale.

The results of the work of the Institute are published in its reports and in special pamphlets, technical journals, and by means of lectures, practical demonstrations, etc.

Forest Management Division

The research work of the forest management division concerns silviculture and forest mensuration, and its main task is to solve the primary questions of silviculture. These can be divided into two groups, one concerning the management and care of the stands, and the other their regeneration. The methods developed are based on production research and regeneration research.

The task of production research is to find ways of deciding on the best types of tree stands, whether they should be pure or mixed and whether they should be of the same or differing ages, together with the time for the first thinning, the length of the thinning intervals and the time and method for final cutting.

In international forestry many investigations have been carried out to determine the development of stands, the production of various types and the results of applying different methods of management. The material has usually consisted of experimental plots which have been matured over a long period of time and the analysis of the results has hitherto been accomplished by simple graphic comparisons of their development over long periods.

The Swedish Forest Research Institute has, however, for several reasons abandoned these methods and has set out to determine how the tree and the stand grow under various types of natural conditions and different kinds of management.

Production research is now carried out on the basis of observations over short periods which are established as mathematical functions. These serve to generalise the observations and allow a calculation of the increment of growth and certain other functions; production tables are prepared which reveal the amount of growth, the production and harvest for various combinations of the conditions.

The new investigations are based on single observations on temporary experimental plots; the trees are examined for increment of growth; the data relate to pine, spruce and birch forests, as well as to mixed coniferous and hardwood forests. It aims, however, further than the facilitation of production planning, since the careful examination of the habitat and quality of the trees in a large number of experimental plots, where the increment of growth is known, provides a deep insight into the conditions necessary for growth, while consideration of the environment and the race make it possible to separate their respective effects through statistical analysis. Moreover, material gathered from the virgin forests enables a study of the influence of change of climate on production.

The Institute is also studying, in co-operation with the Swedish Forest Products Research Laboratory, the technical characteristics of the forests, as well as their dependence on natural conditions and the management of the stand.

The programme for forest mensuration is also carried out in connection with production research; it includes the development of methods for the mensuration of different trees, as well as the volume of the stand, the class of wood produced and the increment of growth. Pruning measurements are also being studied.

The object of regeneration research is to determine the most suitable methods for regenerating forests and to give directions for their application in practice.

Natural regeneration problems include methods of regeneration cutting, the care of clearings and the carrying out of weeding, as well as mechanical and chemical screefing, burning, etc.

To solve the main problems it is essential to know how the forests are regenerated under natural conditions and different types of management. This is achieved by statistical methods based on observations.

A number of problems also arise in the care of seedlings, the choice of seed, methods of planting, fertilisation, treatment of planting material, spacing of plants, the most favourable planting time and attacks of disease.

To a large extent reforestation work in North Sweden must be based on machinery. The figure illustrates preparation of the ground by caterpillar tractor and special forest harrow

The National Forest Survey. Growing stock is determined by counting the trees on circular sample plots having a radius of 6.64 metres

To solve these, the possibilities must be known, and experimental plots have been laid out according to modern field techniques. Investigations of the costs of planting and cultivation also comprise an important part of the research programme.

Since the quality of the seed sown may be decisive, research concerning the characteristics of cones and seeds, and their storage, is also important.

Forest Survey Division

The main task of this division is to estimate the extent and character of Sweden's forest resources. Repeated surveys are made at intervals of about 15 years and it is also possible to estimate roughly changes which take place in the period between surveys. In this way a check on forest conservation throughout the country can be obtained, while co-operation with the production research teams makes it possible to estimate the quantities of timber which need to be removed for future supplies.

The first National Forest Survey of Sweden was carried out between 1923 and 1929. It was preceded by an experimental survey of the province of Varmland in 1911. The survey of Varmland also later served as a model for the Norwegian and Finnish national surveys. The second national survey, initiated in 1938, was based on the same principles, but increased attention was given to detail and greater precision was developed.

The collection of material takes place in survey belts and sample plots laid out along parallel lines, marked out by a compass at equal distances—the so-called survey lines. In the survey belts, the distribution into various types of land is taken into consideration, while the forest land is divided according to the types of trees thereon, the development of the stands, their composition, etc. In the northern provinces the individual trees are recorded in survey belts, but in southern Sweden this is limited to sample plots in which a more detailed description is carried out and sample trees are registered and examined.

Since the survey is by its nature a probability calculation, the calculus of probability can be used to determine the correct distances between the survey lines and the sample plots to attain the desired degree of accuracy.

Scientific Working Plans Division

This division was started in 1949 with the object of directing forestry operations. Owing to the variety of circumstances which surround the felling and transport of timber, general rules concerning how this work ought to be carried out can only be formulated to a limited extent. Normally particular techniques are suited to limited areas of forest land and this necessitates constant check on locally changing needs and their consequences. By systematic comparison of work in various parts of the country it becomes possible to obtain information on the operation of different methods and thus to evolve new ideas for improvements. The work of the division includes:

1. The study of the wear and tear which occurs in the use of tools (saws, axes, etc.) in forestry work.

2. The study of equipment and mechanical aids.

3. Investigational methods.

The research within the first category aims at clarifying the events which take place in various methods of operation and defining and measuring the power requirement and the optimum rate of cutting. In the case of hand tools the possibilities are limited, and it has been found convenient to assume the normal amount of power which a human being is capable of producing and on this basis to design tools so that his power is used to the greatest advantage. In the use of mechanical aids, such as power saws, there is greater opportunity for designing methods of operation to secure the optimum technological effect.

The selection of equipment and machinery to ease handling and to assure durability, etc., coupled with investigations on transportation equipment, constitutes the second part of the research programme.

Closely connected is research into methods of manual labour, which is of great importance in forestry, and here connected physiological relationships need to be carefully considered.

Botany and Soils Division

Research in this division covers investigations into geobotany, soil botany, mycology, plant physiology and related subjects.

The main task is to increase knowledge of the natural conditions of forestry growth and the work involves study of the often very complex processes which take place in the soil and in trees. A tree's performance is largely determined by the resources of water, plant food, light and warmth available to it, but in the forest the environment is also affected by the basic characteristics due to location and by the competition of other trees and other members of the plant community. Therefore, it is important to examine not only the requirements of the trees and the conditions of the location, but also the other living things in the soil of the forest, as well as the forest-plant communities, their soil requirements and their reactions.

The work of this division can consequently only be defined in broad outline.

In a forestry-ecology experiment, for example, the environment is varied by different types of operation, such as thinning, watering or fertilising. The results can provide knowledge of the nutrient status of the soil and the nutrient requirements of each kind of forest plant.

In the botanical field experiments are carried out on the plant communities of the forest, and particularly on the relation between the different types and the characteristics of the location. The type of forest serves as an indicator to the type of soil and this may be important for forestry management. Geobotanical research aims at testing and establishing such relationships.

The task of soil biological research is to examine the biological processes, important for forestry, which are taking place in the soil. In general the only method of increasing the amount of available food substances in the soil is by appropriate felling and treatment of the soil, and the need is to gather information on the organisms in the soil, their activity and their effect on the trees.

Up to the present, research has mainly concerned itself with the question of how food substances can be liberated from the storehouse of the soil. In the long run, however, it may be just as important to determine how quickly the supply of food substances in the soil can be renewed. Upon this depends the answer to whether the forests can be kept growing well without risk of quickly exhausting the food supply of the soil.

The mycological section is concerned with research on the fungus diseases of trees as well as those which attack forest products, and with the development of methods of controlling fungus attacks.

Snow blight (*Phacidium infestans*), which at certain points constitutes a serious hindrance to the growth of pines, has been extensively investigated. Attention has also been directed to diseases in the plant nurseries. Root rot (*Polyporus annonus*), which attacks stands of spruce in certain parts, and pine blister rust (*Cronartium asclepiadeum*) have also been the objects of investigations.

Storage rot in lumber yards is receiving attention and, in cooperation with the zoological division, investigations are under way to discover the relation between insect attacks and the concurrence of log blue. Field experiments with impregnated timber are being carried out in various parts of the country to determine the effectiveness of different types of impregnating materials.

Research on natural rot fungi in wood has been carried out for several years in cooperation with the Department for Organic Chemistry of the Royal Institute of Technology.

Genetics Division

Research in this division covers plant-breeding of forest trees by selective methods and related questions.

The main task is concentrated around the influence which the genetic make-up of trees exerts on the production of forests. The characteristics of trees are conditioned by heredity and their mutual importance can be established in different ways. The individual genotype can be determined through vegetative propagation in different environments, while the value of the progeny can be tested in various ways, *e.g.* by sowing the seed obtained after open pollination, after artificial crossing or after self-fertilisation.

A national register is being compiled of individual spruce and birch trees chosen because of their outstanding qualities for use in breeding work. The number so far selected is between 2,500 and 3,000.

Sweden's total requirement of coniferous seed is calculated to be about 60 tons per year. At present not even half this can be produced. To meet this shortage, and to improve the quality of existing stands, it has been proposed that special seedling plantations should be established on which valuable trees are propagated by grafting, brought to early blooming and cross-bred. This, it is hoped, will be of invaluable service to Swedish forestry.

In progeny experiments, different trees and races of trees are also studied, in cooperation with the entomological and mycological staffs of the Institute, for resistance to attacks of fungus disease and injurious insects.

From the earliest years work has been carried out on the region of origin of seeds of trees; this is known as provenance research and is of importance in knowing the limits within which seeds of forest trees can be transferred without imperilling their growth, while it must also be ascertained whether by systematic transference of seeds between different latitudes or different climatic conditions advantages can be gained in the quantity and quality of the timber production.

Zoological Division

The animal life of the forest includes many animals both injurious and useful; insects are the most numerous and indeed play a much greater part in the forest than other living animals from an economic point of view. For this reason the zoological division concerns itself mainly with problems arising from damage caused by insects.

One of the main tasks is to investigate the habits of insects. Particularly important are biological and ecological investigations of two of the most dangerous bark beetles, the pine beetle (*Blastophagus piniperda*) and the eight-dentated bark beetle (*Ips typographus*). Information about the life history of injurious insects is of great importance, since it can show the conditions under which particular insects have the least power of resistance and can therefore be most easily combated.

Methods have also been devised for estimating the numbers of insects in an an epidemic, as well as the extent of the damage which they cause. These enable judgment to be formed of the extent of the combative measures needed to minimise the damage.

The most important task of the division is to devise effective measures, both pre-

Dusting severely insect damaged forest with DDT powder from a helicopter

Reproduction front in pine forest, Middle Sweden

ventive and directly combative, to be applied against injurious insects.

Another important problem is the relation between certain injurious insects and injurious fungi. Some forest insects infect trees or timber with spores of injurious fungi, *e.g.* certain bark beetles infect timber of pine and spruce with fungi which cause the discolouring of the sapwood, known as log blue.

Studies of the animal life of the forest soils are also carried out, which provide wider knowledge of the forest soil fauna and its significance in soil processes.

Current research projects also include modern methods of spraying or dusting forests by air with contact poisons against the dangerous pine-moth (*Bupalus piniarius*). In this case DDT has been used and with its help extensive areas of forests were completely freed from these injurious insects in a very short time.

Department of Statistics

The application of statistical methods, particularly regression and variation analysis, to the problems of advanced forestry research has given most successful results, and a special department has been set up to provide the various divisions of the Institute with statistical analyses of experimental results.

Besides the close cooperation between various departments in the Institute, contact is also maintained with other scientific institutions, as well as the practical forestry industry.

Photos: Forest Research Institute of Sweden.

NEW BOOKS

The Injurious Insects of the British Commonwealth

By J. W. Evans, M.A., Sc.D., D.Sc. Pp. vii + 242. Commonwealth Institute of Entomology, 1952. 30s.

As stated in the introduction, the object of this book is to provide a source of reference to, and concise information on, most of the injurious insects found in the British Commonwealth, except Great Britain, India and Pakistan; the latter two were omitted, we are told, because their problems, in addition to being very numerous, differ in many respects from those of other parts of the Commonwealth, and to have included them might have obscured features which it is desired to stress.

With this limitation it must be conceded that the author has rendered a notable service in the preparation of this work for which all connected with the entomological problems of the Commonwealth have reason to be grateful.

The book is divided into five parts of varying length. Part I deals with the territories concerned, giving brief geograpical details, a concise summary of the principal medical, veterinary and agricultural entomological problems and the origin of entomological services there. The second part lists the principal crops grown in the various countries and the insect known to attack them. Part III, the longest and most important, deals with the various genera of insects recognised as pests in agriculture, horticulture and forestry, arranged alphabetically according to their natural orders. In particular it provides much information about the parasites known to attack various pests. Part IV is a short but useful section dealing with the control of various weeds by means of insects introduced from different countries, while Part V is concerned with various special problems such as plant quarantine and the biological control of insect pests.

The book contains as a frontispiece a portrait of Sir Guy Marshall, F.R.S., founder and first Director of the Institute of Entomology, and who was so largely responsible for building up the Institute to the pre-eminent position it now occupies.

The book itself is admirably got up in a neat blue cloth binding, while the paper and printing are excellent. In this respect it constitutes a marked improvement on preceding monographs of the Commonwealth Agricultural Bureaux with which the Institute's publications are associated.

Vegetable Oils and Oilseeds

A summary of figures of production, trade and consumption relating to groundnuts, cottonseed, linseed, soya beans, coconut and oil palm products, olive oil and other oilseeds and oils. Compiled in the Intelligence Branch of the Commonwealth Economic Committee. Pp. xix + 146. H.M.S.O., 1952. 5s.

The quantity of vegetable oils available per head of the world population is now significantly higher than pre-war, and this review of production and trade shows that world production of oilseed crops in 1950-51 maintained the high level reached in 1949-50, while preliminary details for 1951-52 indicate a further marked increase in production to a new record level. Prices, which reached very high levels early in 1951, have since fallen considerably and are now, in general, at or below the levels prevailing before the Korean crisis.

The Commonwealth is an important producer of most of the main oilseed crops, and in post-war as in pre-war years has accounted for over one-fifth of the world production. It is an even more important supplier of the oilseeds and oils entering international trade and normally provides some 30% of these supplies. In 1951, however, this proportion fell to 27% due mainly to a temporary decline in shipments of groundnuts from Nigeria. Prior to the war, the Commonwealth had a large trading surplus in oils and oilseeds, particularly in groundnuts, copra and palm kernels. The subsequent decline in exports from India has more than offset heavier Nigerian shipments, while United Kingdom purchases are now much greater than in pre-war years. Thus in every post-war year the Commonwealth has been a net importer, particularly of linseed, sunflower, soya bean and cottonseeds.

It seems probable that an increase in the Commonwealth balance will occur during 1952 since Nigerian shipments are above the level of last year, while United Kingdom restrictions on non-sterling purchases will also have effect.

Commonwealth net exporting countries, other than Nigeria and India, include Ceylon, Malaya, New Guinea and Papua, Fiji and other British Pacific Islands, British East Africa, Sierra Leone and the Gambia, in each of which there have been developments in the oilseed industry since the war and, in general, some increase in production. Canada and Australia are

now the only other net purchasers of more than minor importance.

A significant post-war development in world trade in oils and oilseeds has been the increased proportion shipped as oil, as opposed to seed, following the expansion of crushing plants in many important seed-producing countries; Canada, South Africa, India, Pakistan, Ceylon and Fiji all show developments along these lines.

Sand and Water Culture

Methods Used in the Study of Plant Nutrition, by E. J. Hewitt, B.Sc., Ph.D. Pp. x + 241, illustrated. Communication No. 22 of the Commonwealth Bureau of Horticulture and Plantation Crops, 1952. 42s.

In the Foreword to this book Sir Edward Salisbury, Director of the Royal Gardens, Kew, and Vice-President of the Royal Society, points out that methods of sand and water culture have proved of the greatest value in assessing plant nutritional requirements, while the discovery of the significance of the micro-nutrients has given them greatly added importance and at the same time called for great improvement in the techniques employed.

In this book Dr. Hewitt has provided a compendium of up-to-date information on the subject. It is designed for the specialist rather than the general reader; nevertheless it is of interest in view of the delicacy of the techniques and the rigid nature of the precautions which have to be observed in connection with work of this type.

In working out methods and applying them Dr. Hewitt has himself made notable contributions in connection with the remarkable work carried out at Long Ashton Research Station under the general direction of Professor T. Wallace, C.B.E.

The book will be welcomed as a standard work of reference for many years to come. It is illustrated by 25 figures in the text and nine plates; there are also 23 tables of data connected with the work. The volume, bound in green cloth, is well presented.

Murphy Spraying Programme

The Complete Spraying Programme, 1952. Pp. 96. Illustrated. The Murphy Chemical Co., Ltd. 1952.

The latest (1952) edition of the Complete Spraying Programme, handbook of the Murphy Chemical Co. Ltd., is as usual full of useful data for fruit growers, hop growers and market gardeners. Since 1951 Murphy have revised their recommendations and brought them up to date. A useful introductory feature discusses the relative advantages and disadvantages of winter washing and spring spraying. Another useful section is that on mineral deficiencies.

To Authors and Readers

The Editor and publishers of WORLD CROPS will be glad to consider manuscripts of books submitted for publication. We already publish a number of books on technical subjects, all of which find a world sale, and most call for regular reprints and new editions.

Books of a non-fictional type in any language by any publisher can be supplied by the Book Department of WORLD CROPS.

Fruit

A summary of figures of production and trade relating to fresh, canned and dried fruit, and wine. Compiled in the Intelligence Branch of the Commonwealth Economic Committee. Pp. xvi + 144. H.M.S.O., 1952. 5s.

International trade in fresh fruit showed a further marked expansion when in 1951 exports of the 12 most important kinds amounted to 5.4 million tons, as against $4\frac{3}{4}$ million tons in 1950 and the 1934-38 average of $5\frac{1}{2}$ million tons.

The output of deciduous and citrus fruit in the principal producing countries during 1949-51 totalled, on average, more than 33 million tons a year as against 29 million tons in 1944-48 and 26 million tons in 1934-38.

Commonwealth production in 1949-51 was almost 50% greater than in 1934-38. The report notes the steady progress in citrus fruit production in colonial territories such as the West Indies, British Honduras and Cyprus.

So far as international trade is concerned, the principal banana producers are now the Honduras Republic, Ecuador and Costa Rica; efforts to restore production in Jamaica, much reduced by the war and disease, continue to be hampered by hurricanes. Except in the Far East, pineapple production is now well above the pre-war level; steady progress is being made in the restoration of the Malayan industry and considerable development is taking place in South Africa, which became in 1951 the largest Commonwealth producer.

Spain, with a total of over 800,000 tons (exclusive of banana exports from the Canary Islands), became the world's leading exporter of fresh fruit last year, mainly as a result of much larger orange exports.

Output of canned fruit in the United States, including the Hawaiian pineapple pack, was at a near-record level in 1951, amounting to over 1.5 million tons, and accounted for about 80% of world output. Canned pineapple output in Malaya, though recovering steadily, is still well below the pre war level. Elsewhere in the Commonwealth the canning industry is being developed, notably in the British West Indies and Fiji.

Jute Substitute Fibres

By A. E. Haarer, F.L.S., with a Foreword by Sir E. John Russell, F.R.S. Pp. xxii + 185, illustrated. Wheatlands Journals Ltd., London. 30s.

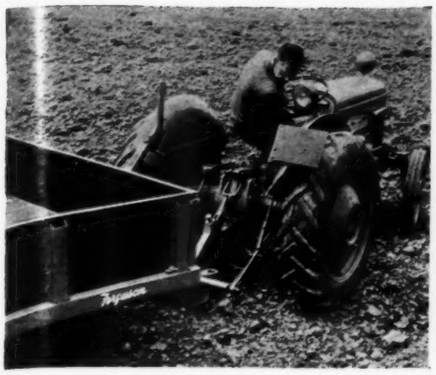
The enormous rise in the price of jute which has taken place of late years has directed attention to the possibility of using other fibres to replace it, particularly bast fibres obtained from the stems of various plants. Consequently, the appearance of this book by Mr. Haarer must be regarded as timely, since it gives a good deal of useful information about three members of the group of fibres which can be used as substitutes for jute, and which give the greatest promise of proving economically capable of successful development. The author is well known to readers of this journal inasmuch as a number of papers from his pen have already appeared in these pages, including some dealing with the subject of this book on which he is recognised as an authority. The three fibres described are Bimli Jute or Kenaf (*Hibiscus cannabinus*), Roselle (*Hibiscus sabdariffa* var. *altissima*) and Aramina fibre (*Urena lobata*). In the pages of his book Mr. Haarer describes the characteristics of each of these and discusses their prospects as crop plants.

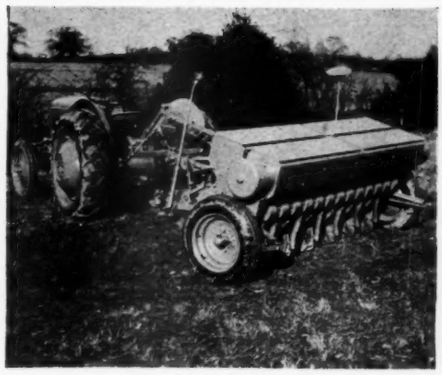
The most promising appears to be Kenaf which, although somewhat coarser than jute, can be mixed with jute in spinnings, but Roselle fibre may run it close. There have been considerable developments with Kenaf in America and Cuba, as well as in South Africa, where it is known as Wilde Stokroos, and in India itself. The book also deals with the vital question of methods of extracting the fibres from these plants and, in addition, contains much valuable information on botanical and other aspects.

The book is well presented and is illustrated by four coloured plates and some 52 well-chosen photographs and line drawings by the author.

We can cordially echo the words of Sir John Russell in his foreword that 'those who are contemplating developments with these fibres and all who are interested in economic botany in general and in fibres in particular will find this book useful and interesting.'

H.T.





The Ferguson range includes (*left*) the automatic hitch, (*centre*) the combined Universal seed and fertiliser drill and (*right*) the one-man manure loader and spreader

INDUSTRY'S CONTRIBUTION TO AGRICULTURAL RESEARCH—XII

The Ferguson Organisation

A. B. LEES

In this article, which forms the twelfth in this series dealing with research carried out by commercial firms, the author describes and discusses the various aspects of the investigations carried out in a number of countries by the Ferguson Organisation.

IT is only to be expected that the Ferguson Organisation, with headquarters at Coventry and Detroit, should act almost as a magnet in attracting problems connected with engineering and agricultural techniques, and both long- and short-term problems are inseparable from the production of 14 tractor models and 65 implements. For those connected with the soil, however, the interest lies in the performance of the machines and their economic deployment, and very little satisfactory development can go on without always keeping in mind that the true object of farm mechanisation is to enable highly-paid workers to produce the maximum amount of food at the lowest cost while building up soil fertility.

An endless variety of inconstant factors is the outstanding feature of agriculture, as far as the application of mechanical power is considered. Mechanisation in a factory deals largely with inert material which is relatively constant in physical characters; on the other hand the physical character of the soil on a farm may vary not only from field to field, but in different parts of the same field, while its condition may change from day to day with the weather, cropping system, management, etc. Few crops, even of identical varieties, are the same in every way; they vary in density, height, toughness and many other respects which can be controlled to only a limited degree by the farmer. Although under full mechanisation the farmer has the right to expect that his machines are able to cope with all the diverse variations encountered.

Types of plough

In five years over 172,000 mouldboard ploughs have been despatched from Coventry, yet in India, Africa and other territories fieldmen are still showing by demonstration how the disc plough can, in certain conditions, show advantages both as regards financial economy and soil treatment. Cumulative experience in ploughing virtually round the world has, however, focused attention on the non-abrasive soils like the Bedfordshire clays and the black cotton soils of India and other Commonwealth countries. Because mouldboards will not readily scour in these soils, ploughing is rarely of first-class quality and in addition a high proportion of power is wasted. Many types of mouldboard, including open ones with roller dives to assist the slip of the furrow, have been tried. Very promising results are now being obtained with mouldboards faced with chrome steel. The additional expense can be recouped in about 50 acres of work through driving improved furrows with less power. Wear and tear is negligible and the extra life seems likely to cancel the extra cost. Further research is necessary, however, before chrome steel mouldboards can be offered as optional or service parts.

Training facilities

Every Ferguson distributor, of which there are 72 in the Eastern Hemisphere, has certain obligations as regards field service training of all personnel. The mechanised farming schools, which are the seat of educational activities, provide the land for experiments on performance, deployment of existing and new machines, and exploring the possibilities of new techniques in cultivation, crop production and disposal. The training school headquarters is at Stoneleigh Abbey, Warwickshire, where on 150 acres some ten instructors with high qualifications in agriculture or maintenance engineering, or both, work with a normal complement of 30 to 40 students. Fortunately, field proficiency can be as easily acquired in testing new techniques as in routine work. Thus the facilities available here were invaluable in developing a new seed drill which deals with almost every type of seed met with in practice.

Schools with comparable resources have also been set up in India, South Africa, Denmark, Sweden, France, Norway, Turkey, three Australian provinces and other countries. In Pakistan, where no tractor is sold until the buyer or his operator has had two weeks' training, there were, in June last year, no fewer than four schools, although in this case the sites change from time to time. It is, in fact, an interesting experiment to assess the merits of fixed or travelling schools.

Engineering research division

These field stations, as they may be called, are additional to the field testing section of the Engineering Research Division which, in addition to carrying out

tests to obtain engineering data, also takes prototypes to many countries for development and testing and sends others to independent farmers for prolonged field trials. There is no fixed programme of research except in as far as it affects particular projects, and this ensures freedom from obligation to publish reports and results. Findings are, of course, reported and circulated to all interested, but the results of research are in the main to be seen in the Company's products and future programme. Knowledge of a fundamental nature is recorded and filed under the heading of its subject matter, while a central library files all current information over the whole field of agriculture and agricultural engineering. Closely allied to these is a Statistics Department which deals not only with Ferguson figures but also with data connected with many different countries.

Examples of research results

To give some examples of the results of research we may start with the tractor. The basic intention here was to produce a lightweight machine with implements integrated to it so that they and their work provided weight for traction in proportion to the actual need. In this way flexibility in use could be achieved with economy in power and fuel. The findings of official research in the 1920's and even in the 1930's supported the then current theory that the future lay with large and heavy units working vast acreages. On the other hand, the majority of the world's food producers are small peasant-type farmers and the real problem was only disregarded by implying that smallholdings should be reorganised to form economic units suitable for mechanised operations. Mr. Ferguson believed that engineering should serve agriculture, and should not seek to regiment industry in the face of deep-rooted social and psychological trends and with doubtful economy. As a result years of untiring research in both hemispheres were devoted to establishing the optimum power and weight for the complete universal farming machine that could be equally well operated by the large or the small farmer.

Research on implements

To cut right across accepted practice and produce a tractor with weight reduced by as much as one-third brought with it the need for research on all kinds of implements, quite apart from developing the correct method of mounting them and providing improved safety precautions, for which the need became greater as tractor and implement were integrated. The result has been that the hydraulic unit in the tractor acts virtually as a nerve centre in controlling and safeguarding the implement in use.

Even in regard to what at first sight might appear to be the minor matter of adjustments in the field, research was necessary; thus time saved by tractor operation can easily be lost by the lack of one of the numerous spanners which used to be thought necessary, and the introduction of one double-ended spanner involved much intensive work to standardise nut sizes.

Automatic coupling

During the past two years a notable achievement has been the introduction of the automatic coupling of tractor and implement. Beginning with the idea that a tractor must be capable of universal application so that the fixed overheads like depreciation can be spread over the optimum number of hours' work, it was noted that on a one- or two-tractor farm the machines may have to be switched from one job to another up to six times in a day; with trailed equipment each switch could scarcely be effected under five minutes, while in awkward situations some could occupy 15 to 20 minutes, particularly when the occasional cigarette served as a prelude. In many cases the driver had to dismount and manhandle the clevis on the implement to the required hole on the tractor drawbar. Alternately he would attempt to operate the tractor clutch while standing on the ground or call for a helper on the ground while he operated the tractor. Apart from time, the situation was dangerous to thumbs and knees.

The final result of this study was seen in the automatic hitch which enables the driver to couple or uncouple while seated on the tractor. Dismounting and the temporary 'propping up' of implements is eliminated. For example, the driver now can accurately reverse the tractor to the trailer so that a hinged hook in the dropped position is located under the eye of the implement coupling member. At a finger touch of the hydraulic control, hook and eye are raised so that tractor and implement are securely locked and ready for work. Devices with similar principles are now appearing in many quarters and the whole outlook of farm mechanisation has been brightened.

Manure handling

Government research was a starting point for the development of a new approach to handling farmyard manure. When the National Institute of Agricultural Engineering published the results of their Farm Mechanisation Enquiry, setting out the details and timing of many different methods in use all over Britain, it became clear that the small farm with possibly one tractor and only one man was hopelessly handicapped through insufficiency of transport units. Automatic coupling could be applied beneficially to the whole sequence of loading, transport and spreading, and the development of the one-man one-tractor manure handling combination became, after due development, a practical reality. The one driver can load, carry and spread 40 to 50 tons a day over an acreage ranging from two to five or more without having to dismount in the normal course of work.

Seed spacing

Notable among research on individual implements and the farm practice behind them has been the work devoted to the precision spacing of seed of maize, cotton, sunflowers, groundnuts and several types of pulse. Ferguson's research staff spent many months in Turkey, Tanganyika, Kenya and South Africa, not only in testing the principles for individual seed spacings, but also in finding common denominators for the extra wide range of spacing requirements and seed characteristics. The universal seed drill mentioned earlier, however, is used for sowing continuous rows and should not be confused with seed spacing.

Tractor performance

To ensure efficient tractor performance, despite such handicaps as variation of fuel quality in some areas and the vagaries of climate in others, has been the subject of much field research. In the Middle East, for example, kerosene of very low octane rating is the most widely used fuel. Many months of field work in Egypt preceded the appearance of what is known as the Ferguson Lamp Oil tractor. Another example is afforded by tractors in Kenya on the equator working at altitudes of 8,000 ft. above sea level. A modified cylinder head was devised which resulted in efficiency comparable with that of machines in the best conditions in England. The spread of such work ranges from Tasmania to within the Arctic Circle.

Work in India

Harry Ferguson of India Ltd., have conducted many experiments in mechanised farming in that country during the past three and a half years. Advice and help has been freely given to official bodies such as State-owned Experimental Farms and Directors of Agriculture, while independent work has been conducted mainly in Mysore and Malabar states.

Greater efficiency in rice production is the vital problem throughout India and, indeed, throughout the greater part of the East. Although the tractor can work small areas and generally get over bunds virtually without damaging them, there is urgent need to reduce production costs of wet rice. The avoidance of the costly work of transplanting and better weed control are complementary lines of approach.

So far the procedure adopted has been to apply water to the field and allow the weeds to grow, then drain off the water and work the soil with the rotary hoe leaving the weeds to die. As soon as this has been done satisfactorily, a further limited amount of water is applied and the seeds broadcast.

Thereafter a second treatment with the rotary hoe is given which brings to the surface a second crop of weeds and buries the seed. This has been tried on four occasions with very satisfactory results; it has reduced the cost of rice production by something like half, while on three test areas, yields have been increased by as much as one-third.

In several countries considerable promise attaches to the substitution of normal wheels by open paddle wheels which, in some cases, avoids the use of any cultivating implement for the paddling process.

Harvesting rice

Rice harvesting is handicapped by the small size of the paddy fields and the extremely limited finances of the grower. But so long as the grower continues to rely on the inefficient threshing method of treading out the grain by bullocks, he will not only remain short of money but too high a proportion of the crop will be wasted.

Two problems constantly recur in harvesting: (1) The grain must be dead ripe for efficient threshing, and (2) as soon as it is ripe it is liable to suffer damage by wild monkeys and other agencies and is liable to loss from shattering by wind and dust storms.

At present experiments are going on to devise an improved method of harvesting. Promising results have been obtained by cutting the crop in a slightly unripened state by a self binder, stacking it and threshing it as required and hammer milling the straw for use as livestock feed. Several years, however, must elapse before a method that is anything near universally satisfactory can be evolved. Meanwhile, wasteful and inefficient methods are being improved.

Even in general cultivation it has been found that disc ploughing every three years with only surface cultivation in the intervening years is the best way of conserving moisture while keeping costs to a minimum.

Ferguson tractor discing in a paddy field

Conclusion

Sufficient has been said to show the wide scope of the investigations which a world supplier of agricultural equipment has to carry out if his products are to maintain a leading position. The normal route for distributing information so gathered is by means of bulletins to distributors and dealers whose fieldmen pass it on to farmers and ancillary interests. Material of general interest is frequently published in the form of booklets and articles offered to the trade and technical press. Service information is periodically issued to all holding the large Service Manual. An additional medium is the monthly publication of the *Farming Reporter*.

Bearing in mind the many problems of material and methods of production which constantly call for investigation, research of one kind or another plays an ever-increasing part in industry. Its contribution to the common good is reflected in the product and in the appreciation of the public as shown by the sales position, for although the user may be unaware of much that has gone into what he buys, popular appreciation of products that have been well conceived and are well executed is not lacking.

Predicament of South African Cotton Growers

(From our Cape Town Correspondent)

A few years ago South African farmers were admonished to grow cotton to make the country independent of imports of this raw material.

Certain areas in Natal, in the Barberton district of the Transvaal and near Upington in the Cape were put under cotton and a sizeable production was obtained after some efforts in vermin eradication. Since then the crisis in the textile industry has intervened and much of the cotton cannot be sold locally. Imports of Japanese piece-goods, which now fill the shelves of merchants, are held responsible for the inability of the industry to absorb the local cotton crop. One of the large cotton mills on the Rand recently acquired a quantity of cotton at about 1s. per lb. only after the Government had given an order for the finished product. Another grower was offered 10d. per lb. from a firm in Natal. In the circumstances the growers of long-fibred cotton have been in touch with Liverpool in an effort to sell at the price of about 40d. per lb. quoted in England, but it is not certain whether they will be allowed to export their material. Another difficulty has arisen in the case of a cotton mill in the Cape which is ginning cotton from Natal and is charged higher railage rates than those enjoyed by the growers of untreated cotton. If a recurrence of the events of 30 years ago—a collapse of cotton growing—is to be avoided, some agreement will have to be reached on this matter, at least where cotton is not quite up to export standards. One or two producers have said that they may be returning to the growing of lucerne, which has proved profitable in the past. The cotton mills may ask for protective duties on piece-goods similar to those granted for worsted piece-goods some time ago. This will not help until the glut of supplies is removed.

The Application of Electronics to the Cleaning of Agricultural Products

D. M. TOMBS, M.Sc., D.I.C., A.M.I.E.E.
Senior Lecturer in Telecommunications, Imperial College, London University

ONE of the major world problems of our time is the provision of food for a population that is increasing at a rate of about 30 million per annum. There is certainly need for more food and also need for its more economic use. Since soil can feed a larger population on vegetable rather than animal products, further emphasis is thrown on the handling of vegetable and grain crops and the selection of good from bad.

The problem

The process of cleaning grain uses a variety of techniques, including sieves and vibration, pin machines and brushes, forced draught and suction, gravity, magnetism, and so on. One serious type of problem, however, has remained and this is the discoloration of part or all of a single grain. The only solution for coffee, nuts, peas, beans and many other grains has been by hand picking. The reduction in grade and value of a bulk by a small percentage of discoloured articles has reached very serious proportions in all producing countries. Though the cost of hand picking is not serious with higher priced commodities, it is becoming more and more prohibitive in the case of cheaper ones, with the result that immense quantities of food which should be available for human consumption are traded as cattle food. Also to be solved was the problem of the separation of different varieties of seed where the sole difference lies in colour or even shades of the same colour.

This article describes a machine based on a novel combination of electrical principles, including the utilisation of the pulse technique, developed during the war for radar, for the automatic extraction of discoloured grains. The problem which had to be solved consisted firstly of selecting, by optical means, the grains to be extracted, and secondly, of devising a reliable method of extracting them. The second of these will be considered first.

Extraction of undesired grains

Mechanical forces are required for the ejection or extraction of discoloured grain. Provided the speed of sorting does not need to be high, as is the case for large objects, simple mechanical or air-blast ejection can be employed. For comparatively small objects like the grains named above, such methods are not fast enough and other methods have had to be sought and found.

In seed supplies of all descriptions more and more insistence is being laid on purity and freedom from contamination with discoloured and foreign material. Various devices are already in use for effecting the separation of such material. The following article gives details of a new and ingenious method of effecting such a separation employing electronic principles.

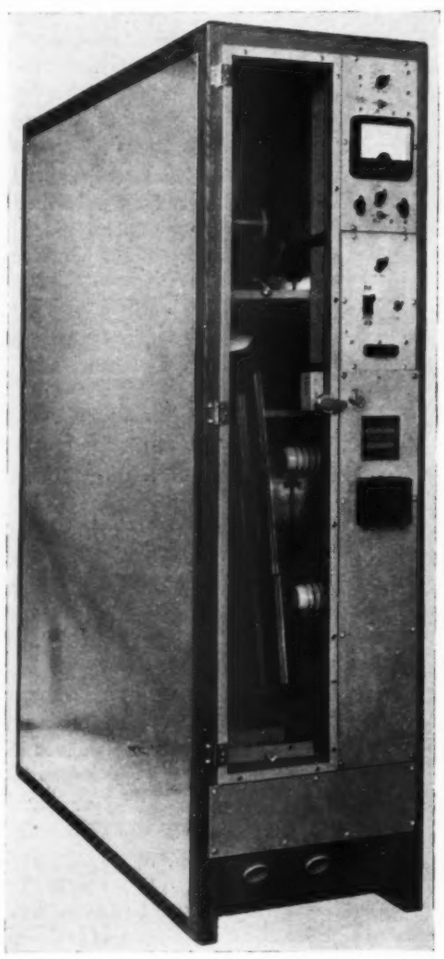


Fig. 1—Front view of Sortex machine

Method using magnetic fields

Readers may be familiar with the ingenious method of separating the seeds of certain injurious weeds from clover by mixing the undressed seed with fine iron powder; this clings to the rough surface of the weed but not to the clover. When this mixture is passed over a strongly magnetised cylinder the powder-clad seed is attracted to the cylinder while the clover flies clear. This method is probably the most efficient for completely extracting certain injurious weeds, like the parasite dodder, from clover seed.

Method using electrical fields

The idea of using the electric as distinct from the magnetic field is believed to be more recent. It requires some means of placing an electric charge on a faulty grain and allowing it to fall in an electric field, much as the iron dust is placed on the weed seed and allowed to fall in a magnetic field. This is done by a corona discharge, as herein described.

Figs. 1 and 2 show the front and rear views of a machine working on these principles. Development of the early machine was initiated ten years ago by Dr. F. Okolicsanyi and his team. Fig. 3 shows a diagrammatic sketch of the apparatus. Basically it consists of a horizontally moving feeding belt driven by a $\frac{1}{8}$ h.p. induction motor which delivers, one at a time, a stream of the articles to be sorted—beans, for example—at 80 per second. They are thrown off the belt horizontally and fall under gravity in a parabolic path. At the end of this free fall they would normally land in the 'accept' bin. During their flight, however, they are viewed some 6 in. below the feeding belt, by two photo-cells placed almost opposite each other so as to view as much of the surface of the falling object as possible. They are not placed exactly opposite each other so that they may view the object against a background of roughly the same colour density, since this allows for the desirable feature of the differences in size of the objects being neglected by the photo-cells. In addition, if a large area of the surface of

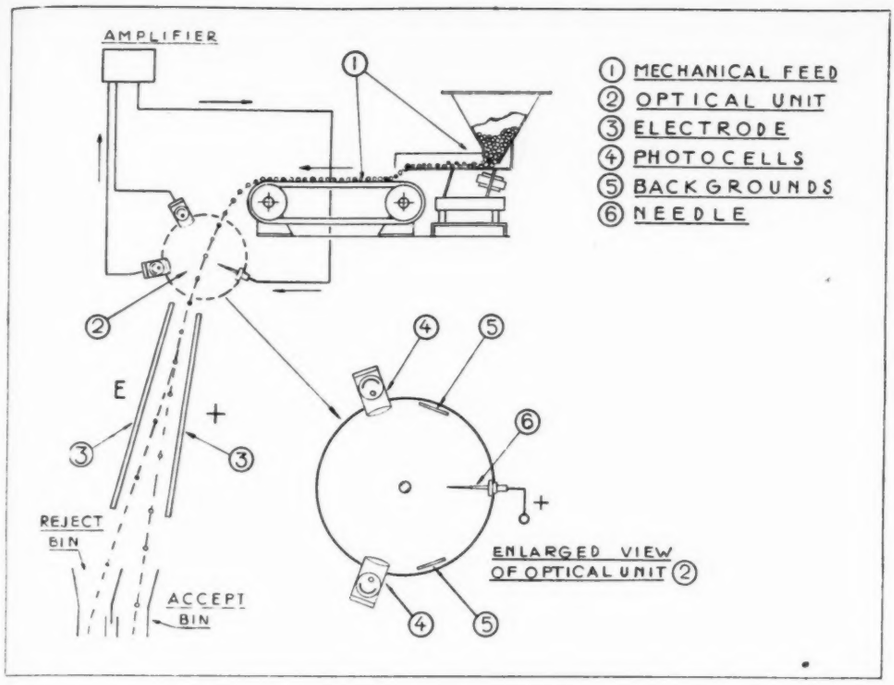


Fig. 3—Diagrammatic sketch of apparatus

the grain is viewed, a light coloured spot may compensate for a dark spot and the photo cell output would be nil. Only a narrow strip of the falling object is thus viewed at any one time, the partial scanning thus achieved proving adequate.

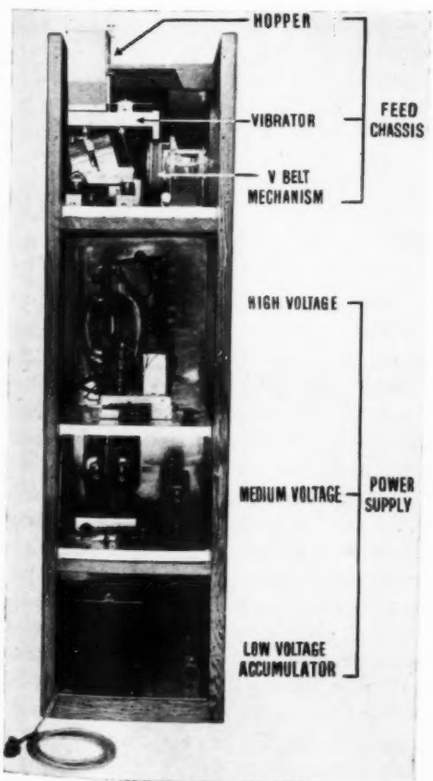


Fig. 2—Rear view of Sortex machine

Adjacent to the photo cells and near the path of the grain is placed a needle, which is connected to a high voltage supply. The amplified output from the photo cells switches on the voltage, which remains on for a very short predetermined period of time, and is then automatically switched off. Either a dark spot or a light spot can be made to do this, though the normal adjustment is for dark-spot extraction. When the voltage is switched on to the needle a corona discharge takes place from the point and the bound charge on the needle-side of the grain is neutralised, leaving the discoloured grain charged. Thus the stream of particles continues its flight, the faulty objects carrying a charge while the good ones carry none. The stream now falls between a pair of long electrodes between which is maintained a large difference of potential, which causes an electric field of force between them. It is well known that a charged object will experience a mechanical force in an electrical field. In this case the force is sufficient to give a 4-in. separation between the good and bad grains.

Readers will recognise that the principle of operation of the cathode ray tube used in television and elsewhere is the same, the electron of the beam being replaced by the charged grain. What is surprising, however, is that a sufficient force should be obtainable on such comparatively heavy objects as grain, to give a deflection as great as 4 in. This is because, although the object is vastly heavier than an electron, it is very much longer in the field of force than is the electron, and the charge on it is also vastly greater.

Differences in the position of a discoloration on the leading or trailing edge of the grain may advance or retard the switch-on of the corona. These variations are allowed for by the slight spread of corona discharge along the path of the falling grain. This spread, however, needs to be restricted if high rates of sorting are called for, and a corona ring is provided for this purpose.

Construction and facilities

In Fig. 1 the deflecting plates may be seen through the glass door; at its foot is the divided receptacle leading to the two exit funnels. The door is provided with an interlock so that it is impossible for an operator to open the door with the high voltage on. The power supply is controlled from the lower two panels on the right-hand side, while the control of the separation between good and bad seed is obtained from the top panel. In addition, a series of representative test points on the electrical circuits may be selected at will, giving an indication on the meter. This valuable facility, if systematically used, discloses the onset of certain types of failure well before breakdown occurs. It also provides a quick diagnosis when a failure has occurred.

Fig. 2 shows a rear view. Each unit, attached to the circuit by built-in plugs and sockets, may be withdrawn for inspection or interchanged immediately with another of the same type without interrupting the performance of adjacent machines. The top chassis holds (*a*) the hopper, (*b*) the vibrator, which controls the feed, and (*c*) the V-belt mechanism. The lower three chassis provide electrical power, the critical supplies being stabilised. The lowest section houses an accumulator to give ripple-free illumination of the grain in the vicinity of the photo cells. The battery is on continuous trickle-charge while the machine is working and therefore requires only occasional 'topping-up' with distilled water.

The Sortex machine is entirely self-contained and so designed that any number can be arranged in bank formation to give any desired rate of output. Of the earlier types of machine, the Sortex G1 has been running continuously under commercial conditions for over three years, sorting peas and beans.

The more recent Sortex G2 incorporates improvements arising from the three years' experience, and additional improvements of simplification, standardisation and tropicalisation.

The size and weight have been reduced,

and the machine now has a width of 17 in., length 45 in., height 60 in., and weight 4 cwt. The power consumption is only 500 watts. The machines are tropically tested to Fighting Service standards by the Fighting Vehicles Department of the British Ministry of Supply.

Performance

It is thought to be misleading to give figures of performance since the results are obviously so dependent on the nature and condition of the grain which the machine is handling. On a particular laboratory test on 8,000 white haricot beans mixed with 500 brown and sorting at 200 lb./hr. only one or at most two brown beans remained in the white bulk while approximately 1½% of the white were erroneously extracted with the bad. At lower speeds of sorting the errors were practically eliminated. It is, of course, always possible to resort the rejects if it is commercially worth while.

Fig. 4 shows the results of a run on coffee beans. The pile on the left (*a*) being the good (77%) and that on the right (*b*) the discoloured rejects (23%). The speed of sorting was 90 lb./hr., a normal rate of commercial sorting.

Effect on germination

The electric charge remains on the surface of the object, and there is no reason to suppose it could affect either food value or germination. Very careful tests on germination have, however, been made and no trace of deterioration could be found.

Electrical engineers are not normally aware of the problems of agriculture, nor are agricultural engineers aware of the techniques that the electrical engineer can contribute to the solution of these problems. It would thus appear that a closer co-operation between the two branches of engineering would be of mutual benefit.

ACKNOWLEDGMENT

The author is grateful to Messrs. R. W. Gunson (Seeds) Ltd. for permission to publish this article, and to Messrs. H. Frankel, J. H. Southcott, B.Sc., A.M.I.Mech.E., and J. Merritt for their generous co-operation.

Spraying Residues on Tea in Ceylon

In the note with the above title which appeared in our October number (p. 343) the Director of the Ceylon Tea Research Institute has drawn our attention to the fact that Dr. Dike was only responsible for experiments on drift dusting carried out by power operated machines; the remainder of the work was carried out by the officers of the Tea Research Institute. We regret this error.

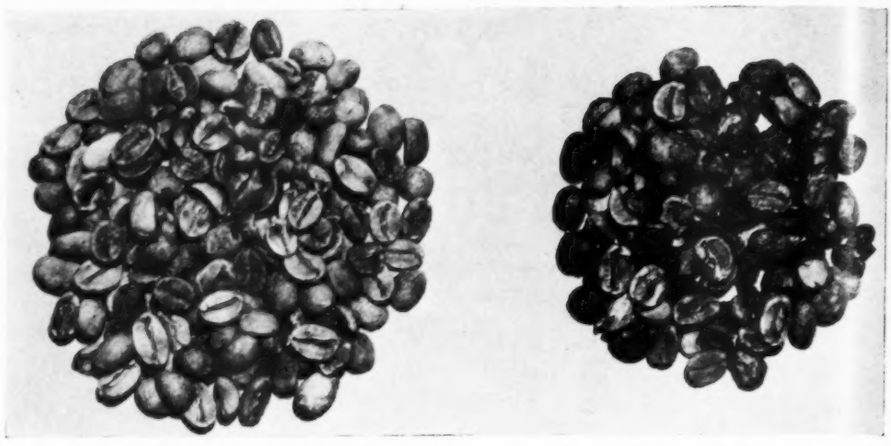


Fig. 4—Coffee beans separated on a Sortex G2 at 90 lb. per hour; (*left*) 77 per cent. (*right*) 23 per cent. The grade of extraction may be regulated on the machine

The London Dairy Show

The 66th Annual Dairy Show, organised by the British Dairy Farmers' Association, was held at Olympia, London, from October 21 to 24, and attracted an attendance of 79,737 during the four days of its run. This was 3,000 higher than last year's attendance, possibly due to the dearth of shows during the summer at which cattle have been on view, because of foot-and-mouth disease. At the time of the show some areas in the south of England were still restricted and representation from these parts was impossible. Entries from other parts of the country were, in many cases, numerically low compared with previous years, owners being of the opinion no doubt that it was better to be safe than sorry, and as the country had not yet been declared clear of the disease it was not worth taking risks. Out of 674 entries 246 arrived at Olympia, the lowest number since before the war.

The two main breeds, British Friesians and Ayreshires, were well represented and once again the black and white cattle carried off the principal trophies. The Supreme Individual Championship Challenge Trophy was won by a five-year-old Freisian cow; the runner-up was also a Friesian. The Bledisloe Challenge Trophy for the best exhibit of good all-round dairy cows was won by Friesians for the fifth successive year; the runners-up were Ayreshires.

The show also included goats, poultry, pigeons, bacon, dairy and horticultural produce among the competitive exhibits, and over 400 trade stands showing dairy equipment principally. Silver and bronze medals were awarded for new inventions in several different classes. In the class relating to the general agricultural industry a silver medal was awarded for a device for making bacterial counts in milk, dairy products, water and other materials. The Harvest Saver and Implement Co. Ltd. was awarded a bronze medal for their 'Siloslyce' silage cutter, a new implement for making clean cuts against the walls or steps of silos.

Potato Harvester Awards

Although no medals were given by the Royal Agricultural Society at the recent potato harvester trials held by them, money prizes ranging from £800 to £350 were awarded to the manufacturers of five machines. The judges considered that harvesters cannot be regarded as satisfactory unless they are capable of a steady average of three acres per day in all reasonable conditions; but, except at the expense of undue damage or an excessively dirty sample, this average output was beyond the capacity of any entry in the prevailing trial conditions.

The machine receiving the highest award was the Globe, driven from the tractor p.t.o. and incorporating a power-driven haulm cutter. The crop is transferred from the share to an elevating drum and main soil separation is done by two power-driven spider wheels. The potatoes are finally delivered to the loading elevator by a sorting conveyor which can be adapted for picking either potatoes or clods. During trials on stony land this machine required eight operators and harvested a 14.2 tons/acre crop at the rate of 2.2 acres per day, leaving 0.9 tons/acre still in the soil. On heavy land five operators were required and the acreage covered per day was slightly increased to 2.4. On Black Fen land eight operators were again required.

RESEARCH DEVELOPMENTS

Storage Behaviour of Apples

TO growers of apples considerable interest attaches to some observations made during the years 1940 to 1948 at the Danish State Agricultural Research Institute by N. Dullum and P. Molls-Rasmussen.

In one series of tests the fruit was stored under the following atmospheric conditions: (*a*) normally ventilated store, (*b*) cold storage at +2.5°C., (*c*) storage in atmosphere containing 9% CO_2 and 12% O_2, and (*d*) atmosphere containing 5% CO_2 and 3% O_2.

In the second series, which was designed to compare the effect of air at different low temperatures, the conditions were: (*a*) normally ventilated store, (*b*) cold store at +5° C., (*c*) cold store at +2.5°C., and (*d*) cold store at +0.5°C. The effect of varying the cooling rate in the cold store was also studied.

Among the varieties examined were Beauty of Boskoop, Boiken, Bramley Seedling, Codlin Springrove, Cox Orange, Reinette, Cox Pomona, Gravenstein, Jonathan and Laxton Superb. The following observations are particularly worthy of mention: Cold storage at +5° showed no improvement over storage at normal temperatures, but +2.5° already brought appreciable advantages such as reduced scald (Boskoop and Gravenstein), less blotch (Bramley) and generally strong inhibition of the growth of fungi. Scald was even more reduced at +0.5° in the case of Boiken, but brown flesh (' Fleischbräune ') was intensified with the more sensitive varieties (Bramley, Cox Orange, Cox Pomona and Gravenstein).

Carbon dioxide storage had the effect of inhibiting development. Scald was more pronounced with Boiken and Bramley and not so marked with Codlin, whilst Bramley and Jonathan were substantially free from blotch. Fungal diseases were inhibited, likewise wilt (Boskoop, Boiken and Jonathan). A serious defect of carbon dioxide storage proved to be the aggravation of brown heart in Boskoop, Cox Orange and Cox Pomona under the conditions of both (*c*) and (*d*).

Concerning the effect of cooling rate it was established that successive reduction of temperature to +5°, +3° and +0.5° usually counteracted brown flesh, but this was offset by greater liability to scald, wilt and fungal diseases. Varieties highly susceptible to brown flesh, such as Cox Orange, may be advantageously cooled down in stages, but rapid cooling is preferable for non-susceptible varieties.

Streptomycin Cures European Foulbrood of Bees

UNLIKE American Foulbrood disease which can be cured by the *sulpha* drugs but not by antibiotics, European Foulbrood, as recent work shows, yields to antibiotics but not to the drugs of the *sulpha* group. Outbreaks of EFB in Canada caused apiarists to direct their attention to the use of streptomycin as a possible curative agent and a recent report shows with what success the investigations were carried through.

Although the mould-formed antibiotics are relatively more expensive than the chemically prepared *sulpha* drugs, preliminary costings demonstrate that for the outlay of about one dollar per colony the produce of a hive can be secured against EFB. In the tests carried out, commercially available samples of streptomycin, terramycin, aureomycin and chloromycetin were fed to colonies at less than 1 gm. of drug per gallon of syrup. The feeding continued for two weeks.

To ensure testing the drugs under severe conditions, healthy combs were deliberately infected with the disease organisms. None of the streptomycin treated groups developed signs of the disease, terramycin was almost as good while aureomycin and chloromycetin were not satisfactory.

Other, naturally infected, colonies of bees, where the causative agent was already well established at all stages of severity, were fed with the antibiotic/sugar syrup. Again streptomycin proved superior to the others tested, and destroyed established infections.

Parallel trials, in which the antibiotic was sprayed on to infected combs, were only partially successful. One-half to a quarter of a gram of drug was dissolved in 1½ oz. water and sprayed on to individual combs. In the tests with artificially infested combs no diseased cells showed within 29 days when the spray solution contained either streptomycin, aureomycin or terramycin. Combs naturally infected and which contained diseased cells at the time of treatment all showed a post-treatment reduction of infection. Chloromycetin was the exception. In none of the remaining treatments with the other drug was the infection eliminated. After 29 days there was considerable reinfection.

Canadian experience with EFB proves that antibiotics need not be 100% effective in suppressing the disease. Provided the disease can be checked long enough for the bees to establish themselves and the honey flow then the disease will frequently disappear of its own accord.

ALAN GOODMAN

REFERENCE
Katznelson, H. et alia. 1952. Scientific Agriculture. **32**. P. 180.

New Publications

The following books, published recently, are available from the Book Department, WORLD CROPS, Leonard Hill Ltd., Stratford House, 9 Eden Street, London, N.W.1

Animal Nutrition, by L. A. Maynard. Illustrated. Pp. 474. McGraw Hill. 55s. 6d.

Frost and the Fruit Grower, by R. Bush. Illustrated. Pp. 119. Cassell. 6s.

Manual of Bacterial Plant Pathogens, by Charlotte Elliott. Pp. 186. Annales Cryptogamici et Phytopathologici. Chronica Botanica. Wm. Dawson. 48s.

Manufacture of Pulp and Paper, by J. N. Stephenson. Illustrated. Pp. 587. McGraw Hill. 64s.

Principles of Plant Physiology, by J. Bonner and A. W. Galston. Illustrated. Pp. 499. Bailey Bros. 47s.

The Molds and Man : An Introduction to the Fungi, by C. M. Christensen. Illustrated. Pp. 252. Oxford. 21s.

Safflower Seed Oil

AGRONOMISTS in several parts of the world are now taking a keen interest in the production of safflower, a note on which appeared in WORLD CROPS, **2**, 136. Specialists now see in safflower oil a valuable alternative to linseed oil in the paint and varnish trade, while from its chemical composition safflower oil may find uses in the food industry as an alternative to sunflower and soya bean oil.

A recent Canadian scientific article has reviewed the results of variety trials conducted in Canada between 1941 and 1948. In the trials reported, varieties originating from Hungary, United Provinces of India and specially bred lines from the University of Nebraska Experimental Station were used. The latter strains were heavier croppers than the earlier varieties and the oil content averaged 20 to 25%, while Nebraska N805 gave better than 31% oil content.

Safflower belongs to the *Compositae* family and resembles the sunflower. The mature plants do not crinkle or lodge and

can easily be harvested by machines. When the seeded heads are mature, harvesting need not follow immediately since there is little shattering of the seeds. Yields of up to 3,330 lb. seed per acre have been gathered from trials in Alberta on the dry warm prairie lands. By contrast, on the moister lands of the east and west seaboards of Canada yields as low as 299 lb. seed per acre have been recorded; experience has shown that the best yields and highest oil contents are obtained under warm, dry conditions, while rainfall greater than 25 in. a year tends to depress yield.

The safflower varieties tested matured in from 104 to 130 days and the trials appear to show that safflower should be sown at about the same time as spring wheat. The young seedlings are resistant to frost damage, but once the flower heads have formed the plants become more liable to damage, and autumnal frosts may be followed by partial loss of crop.

Good yields of seed are obtained under irrigation farming. In the Sudan one variety sown as a winter crop yielded up to 1,800 lb. of seed on the Gezira Research Farm, while satisfactory yields have been obtained in rain land cultivation in the eastern sections of that country.

Canadian comparisons of irrigated with non-irrigated cultivation have shown that yields of nearly 3,500 lb. of seed per acre were taken from irrigated plots. Comparable non-irrigated plots produced 1,500 to 1,700 lb. of seed only.

Eventually safflower may be a serious competitor to linseed. As a rough guide the following calculation may be of interest. Between 200 and 250 lb. of linseed per acre are generally harvested and the seed has an oil content of 40 to 42% so that the oil extracted amounts to about 100 lb. per acre. By contrast safflower yielding 1,500 lb. of seed averaging 25% oil per acre produces the equivalent of 375 lb. of oil per acre.

As a drying oil safflower oil has been shown by tests in Australia to be equal to or better than linseed oil. They also showed that there was less ' after yellowing ' with safflower oil-based paints than with linseed paints; the safflower paints were easier to brush on, flowed better and dried faster and harder than paints made from linseed oil, while when admixed with linseed oil, the resultant paints weathered better than if paints were compounded with linseed oil alone.

REFERENCE

Mr. Gregor, W. G. and Hay, W. D. 1952. Scientific Agriculture. **32**. P. 204.

Problems of the Agricultural Inventor

THE first open meeting of the Institution of British Agricultural Engineers' 1952-53 Session took place recently when a paper on the problems of the development worker was read by Mr. F. W. McConnel, who has been responsible for a number of designs for agricultural equipment of many kinds.

Process of development

He discussed the numerous trials and tribulations which the inventor must undergo before he sees his machine produced in its final form and launched on the market. For any aspiring farmer-inventors in the audience Mr. McConnel's remarks on the relationship between the inventor and the engineer were of great value. The requirements of the farmer from the engineer were, he said, threefold: (*a*) That present machinery should be improved in length of life and in performance; (*b*) that all machinery should be simplified and cheapened; and (*c*) that machines should do work better than existing equipment. The design of the tractor had settled down to a condition of great complication and could only be simplified by trial and error, while a new motive power was wanted. The testing of machines by farmers was a most important requirement and the farmers selected should be relied upon to work the machines hard and to have patience with their teething troubles; it was important that trials should be as searching as possible.

The need for a farm mechanisation service was stressed. It should give advice on how to equip and run the mechanisation of a particular farm within the farmer's means, and help him to decide what farming lines to drop and what to take up; a link, in fact, between practical and technical knowledge.

Discussion

In the discussion that followed, Mr. John Chambers pointed out that once a tractor is tooled up for production it is an expensive business to make alterations to the tooling to fit any design changes that may be made, whereas altering implement design is comparatively simple. Mr. Chambers said that no new development should be governed too rigidly by existing farming methods.

Referring to Mr. Chambers' remarks, Mr. Parker considered that farmers generally change their tractors more often than their implements, the inference being that design changes in tractors rather than implements were more important to the farmer. Mr. Catchpole, a designer of some repute himself, considered that at the present time farm mechanisation is failing in its purpose. The farmer, he said, has been sold machinery to increase production, save labour and speed up the operation, but in many cases these desiderata have not been fulfilled. Development workers should keep on working at the problem of reducing hand labour.

Summing up, Mr. McConnel said that development work, in order to be sound, must be done for the benefit of the man's own pocket (or the firm, as the case may be) and not for the nation's.

I.B.A.E. Smithfield Meeting

During Smithfield Show week, on December 11, at 4.30, in the Richmond Hall, Earls Court, London, a meeting of the I.B.A.E. will be held when Messrs. Cover and Dick will present a paper on ' Fans in Agriculture.'

Calcium Arsenate That Clings

IN spite of the fact that calcium arsenate is considerably more toxic to pests than lead arsenate, the latter is more usually employed because of its better adhering properties and because it is less dangerous to foliage.

Ordinary calcium arsenates are produced by adding calcium hydroxide ($Ca(OH)_2$) to arsenic acid (H_3AsO_4). In France, however, the calcium arsenate produced by the Société Francaise d'Electro-Chimie is made by placing arsenic trioxide (As_2O_3) in the presence of calcium hydroxide and submitting the mixture to temperatures of around 800° C. This method yields a large percentage of basic calcium arsenate and avoids the necessity for precipitation. It produces very low percentages of water soluble arsenic, thus overcoming the problem of foliage scorching.

From the furnace the product is milled to a fineness of 44 microns and contains a guaranteed minimum of 30% As. It has good adhering properties, good suspension in solution and low scorching powers, etc.

SFEC report that it has been used successfully for dusting against the Mexican cotton boll weevil (*Anthonmus grandis*), cotton leafworm (*Alabama argillacea*), cotton stainer (*Dysdercus ruficollis*), cotton bollworm (*Heliothis armigera*, *Heliothis obsoleta*) and cotton aphid (*Asphis gossypii*). It has also been used in spray form against codling moth (*Carpocapsa pomonella*) in apple trees and many other pests.

FARM MACHINERY

THE 1952 SMITHFIELD SHOW

The ' Platypus 28,' new crawler tractor manufactured by the Platypus Tractor Co. and distributed by Rotary Hoes Ltd.

The Smithfield Show and Agricultural Machinery Exhibition is to be held at Earls Court, London, from December 8 to 12. Since we go to press with this issue before the Show commences, we publish below a preview of some of the machinery and equipment which visitors will have an opportunity of examining during Show week. Next month we hope to publish an account of the Show itself.

Special facilities will be available for overseas visitors and there will be a reception office at the main entrance where they may receive tickets and catalogues. A reception room and lounge will be available where members of the British Agricultural Machinery Manufacturers' Export Association and the Agricultural Engineers' Association will be available to help overseas buyers to find the exhibits they are particularly interested in. It is hoped that all overseas visitors will take advantage of these facilities.

Tractors

Clifford Aero and Auto Ltd. (Stand No. 21) will include a range of the standard Clifford cultivator models, with various attachments demonstrating the Clifford one-machine system for small-scale cultivation.

The basic machine consists of a four-stroke air-cooled engine mounted on land wheels, with transmission and gearbox, and incorporating the standard Clifford cultivating tines. The cultivating unit can be removed and various attachments mounted in its place to form other self-contained units for carrying out most operations on the land. These operations include hoeing, ridging, ploughing, mowing, potato sowing and lifting, and so on.

The Clifford machines shown will include models with 12-in., 16-in. and 22-in. tillers, all fitted with engines suitable for working in heavy land down to 9 in. deep.

The power and capabilities of the Clifford machine are exploited to the full in the A.111 model, which employs car-type transmission with two-speed gear-box and plate clutch. Power steering is also provided by incorporating separate wheel clutches; all models employ shaft transmission.

Two recent additions to the Clifford range of ancillary equipment will attract special attention at the Show. These are the garden plough, suitable for use with Clifford models A.1 and B and designed to work with standard land wheels, and also the standard plough attachment fitted on a model A.111 machine.

Other attachments to be exhibited include light hoeing equipment, soil shredder, power take-off, tiller ridge attachment with new type cutter tines and the mowing attachment.

Dashwood Engineering Ltd. (Stand No. 30) will show their Colwood garden tractor, model B, the Coldwood rotary hoe, model RA, and the Hornet motor hoe. The tractor and rotary hoe have recently been reduced in price, as reported in WORLD CROPS last month, to £62 10s. and £75 respectively. The price of the ' Hornet ' motor hoe remains at £45. Standard equipment for the ' Hornet ' comprises a 9½-in. tool frame, two 6-in. ' Planet ' type hoe blades and three cultivator teeth. The power unit is a Villiers 98 c.c. two-stroke engine.

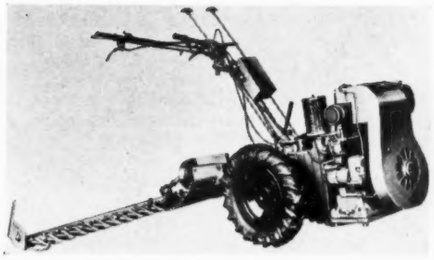
The new Fordson Major is now followed by a new model introduced to meet the requirements of commercial users. This tractor will be shown for the first time at the Smithfield Show by the **Ford Motor Co.** (Stand No. 82).

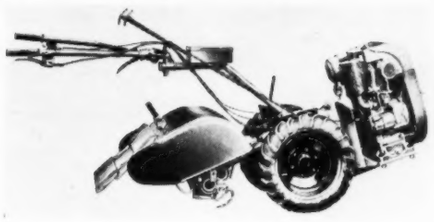
Diesel or petrol engines are available. The diesel engine develops 40.5 b.h.p. and the petrol engine 39.5 b.h.p. at 1,600 r.p.m. There are six forward gears giving variable road speeds of from less than 1 m.p.h. to more than 14 m.p.h. and two reverse gears.

The drawbar on the commercial tractor has been designed to make operation easy, to reduce time wasted when hitching and unhitching loads, and to obviate ' snatch ' when taking up the load. The new rear towing attachment combines an automatic hitch with spring-loaded drawbar.

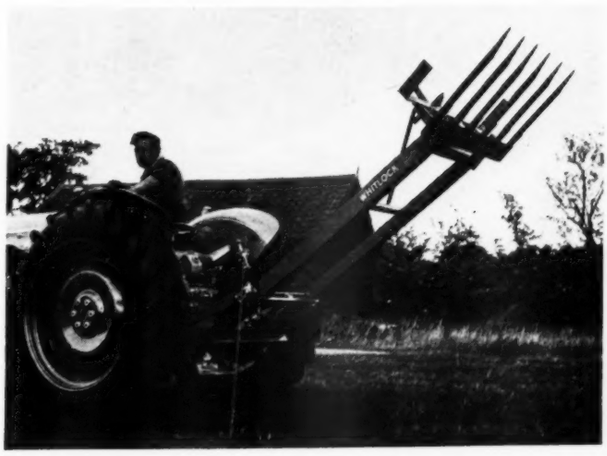
With two exceptions, the exhibits of Messrs. **Rotary Hoes Ltd.** (Stand No. 84) will consist of entirely new machines. Foremost among these will be a new crawler tractor manufactured by the Platypus Tractor Co. and distributed by Rotary Hoes Ltd. This tractor, named the ' Platypus 28,' is a new tracklayer, originally designed as a prime mover for the Howard ' Rotavator ' for work in sugar cane and rowcrops such as vines, coffee, hops and raspberries, but capable of operating with a number of other implements. It is available with either a Perkins ' P4 ' diesel (30 b.h.p.) or a standard 85-mm. bore petrol engine (28 b.h.p.). There are six forward and two reverse gears, differential steering is epicycle gear controlled, track frame suspension is articulated and the tractor's total weight is 4,940 lb.

The Howard trailing ' Rotavator ' is another new machine, suitable for any light-medium or medium (up to 40 h.p.) tractor with a rear p.t.o. shaft; models with 5-ft. and 6-ft. width of cut are available. A machine for trench-digging and pipe-laying in one operation is a further new machine and will be seen mounted on a new Fordson Major with ' Rotaped ' tracks. Other new machines include a sprayer attachment for the ' Rotavator Bantam ' and a vaporising oil model of the Series IV ' Rotavator Gem ' as an alternative to the standard (petrol) model.





(*Above*) **Mowing attachment for Clifford cultivator models A III and B ;** (*below*) **rotary cultivator for Clifford model A III**



Whitlock rear-mounted loader, claimed to operate at a speed equal to fore-end loaders for filling muck spreaders or low loading trailers A sack and bale loading attachment and a buckrake are interchangeable with a manure bucket

Machines and implements

Prototype models of three additions to their range of farm machinery and implements will be shown by Messrs. **Harry Ferguson Ltd.** (Stand No. 77). The new machines are a buckrake, mounted tandem disc harrow and a low volume sprayer.

Hydraulic control of tine pressures over ground contours and a new telescopic carrying

link are features of the new buckrake. The new carrying link assists the operation of the buckrake and also acts as a mechanical latch during transport, thereby eliminating any risk of damage to the hydraulics while carrying the load. It can handle a load of 750 lb., while itself weighing 280 lb.

The Ferguson range already includes a trailed tandem disc harrow and mounted offset disc harrow. The new mounted tandem disc harrow is attached to the tractor by the normal three point linkage. Provided the draft of the harrow remains constant the working depth of the gangs is automatically controlled to a predetermined degree. Should the draft alter, a touch of the control lever restores the required depth.

The low volume sprayer consists primarily of a 45-gal. steel tank lined to resist corrosion, one centre and two side spray booms, the latter fully hinged and raised and lowered by levers attached to the tank side. The gear pump is driven through a universal shaft from the tractor P.T.O. A single cock of special design selects spray, shut off and anti-drip positions. The sprayer also has pressure filter, separate nozzle filters, control levers and pressure gauge. It is attached to the Ferguson tractor by a three point linkage, and held rigidly in position by a self-locking diagonal link of special design. The machine has a low centre of gravity and all weight has been brought as far forward as possible to ensure adequate steering control under all conditions. The spray output ranges from 5 to 20 gal. per acre.

A new four-purpose elevator with adjustable sides will be exhibited by **The Hart Engineering Co. Ltd.** (Stand No. 188). The sides can be closed up to give a tunnel-type elevator for loose grain and small seeds, or opened out fully to give a broad flat elevator suitable for sacks and baled hay ; two intermediate positions are suitable for small roots, ear corn, etc., or large roots, silage crops and corn sheaves. The elevator trunk length is 29 ft. and the conveyor chain is driven by a 1½-b.h.p. Petter engine. Maximum and minimum delivery heights are 17 ft. and 9 ft. respectively. It is mounted on a two-wheel (pneumatic) chassis and has a built-in tractor or lorry hitch. Depending on the angle of elevation, maximum output per hour ranges between 6 and 14 tons of loose grain, 10 and 30 tons of beet, 300 sacks of grain and 1,000 bales of straw.

Messrs. **Jack Olding & Co. Ltd.** (Stand No. 143) announce that they have taken over the world distribution of the range of Wilmo fertiliser distributors, comprising 14-, 7- and 6-disc models. Previously manufactured and marketed by Messrs. Tullos Ltd., of Aberdeen, under the name of 'Tullos-Wilmo,' this equipment is now being produced by Messrs. Alexander Shanks & Sons Ltd., of Arbroath, the trade name now being changed to 'Wilmo.' Export enquiries for the Wilmo fertiliser distributors should be sent direct to the Export Division of Jack Olding & Co. Ltd., 141 Park Lane, London, W.1.

A seven-disc model of the Wilmo range of fertiliser distributors will be exhibited on the stand. The patent feed-discs are capable of fine adjustments and draw the fertiliser through adjustable shutters, ensuring a well-controlled distribution and reducing working costs.

Also on Stand No. 143 will be a selection of Boby seed-cleaning equipment, including the Baker winnower with new sacking-up elevator which is coupled to the machine, and no increase in the power unit of the machine is necessary. It is fitted with sacking-up spouts 3 ft. 6 in. from the ground.

The Baker is suitable for roughing-out and pre-cleaning prior to marketing. After cleaning the grain can be turned over by the winnower and kept fresh during storage. Capacity is approximately 80 bushels per hour.

The Boby 'Cleenestol' three-screen general-purpose cleaner is equipped with an overhead blower, an attachment particularly useful for cleaning grain direct from the combine harvester; straws and a large amount of the green matter are removed prior to the grain passing over the vibrating screens, thus ensuring that the capacity of the machine is fully maintained. The three-screen general-purpose machines are available in two sizes, the 'Cleenestol' with a capacity of 40 to 60 bushels per hour, and the 'Supercleen, 60 to 80 bushels per hour.

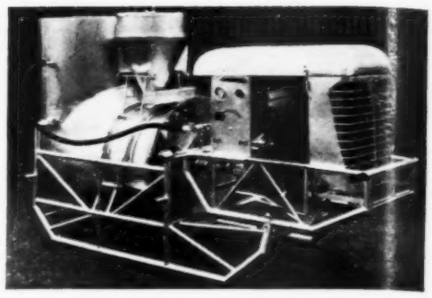
Messrs. Jack Olding & Co. will exhibit for the first time in England the John Deere wire-tying automatic pick-up baler, equipped with an independent power unit. Reports recently received from users of the few machines operating in England during this summer indicated that the balers give an extremely satisfactory performance.

Massey-Harris Ltd. (Stand No. 76) are making a departure from their usual practice of showing a wide range of implements and this year they will concentrate on two new combine harvesters, which will be the only machines displayed. On view for the first time will be the No. 780 self-propelled combine, having a 12-ft. cut and grain tank capacity of 45 bushels. The new combine will be made during 1953 and export orders are already reported to be excessive. A 56-b.h.p. petrol engine allows a speed range of 1 to 7 m.p.h., with 24 variations —the same engine as that on the No. 726 8½-ft. machine. The price of the No. 780 in the U.K. is £1,475, compared with £1,325 for the No. 726.

The other combine to be shown on this stand will be the No. 750 5½-ft. tractor-drawn ma-machine, announced at this year's Royal Show. Powered by a four-cylinder side-valve engine, it has a rotary screen with three-spout bagging attachment and weighs 4,200 lb. Present U.K. price is £695.

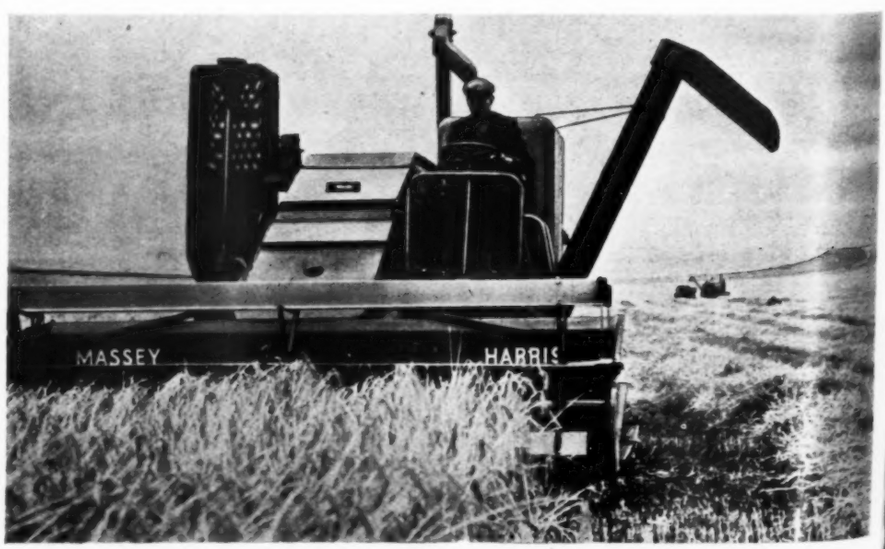
Messrs. **Salopian Engineers Ltd.** (Stand No. 75) will be exhibiting a wide range of their farm machinery and cowhouse equipment. On view for the first time will be the new 'Globe' series of disc ploughs which have been produced to meet the demand for a light and economical plough. Three sizes are available: a five-furrow, four-furrow and three-furrow model, each of which can be supplied with 28-in., 26-in. and 24-in. discs. The power lift is arranged to operate on all three wheels, which ensures good ground clearance under the discs when turning at the headlands and during road transport.

Among other exhibits are the Salopian pick-up balers which are fully automatic and operated by one man. The 'T.D.' is a tractor-drawn model and capable of a bale output of up to 6 tons per hour, whilst the 'E.D.' baler (Mark



Drake and Fletcher's new 'Mistejecta' export model sprays both liquid and powdered insecticides to heights of 80-100 ft., or horizontally to 200 ft.

Allman's midget engine-driven duster. The engine is a 34 c.c. two-stroke, made of light alloy

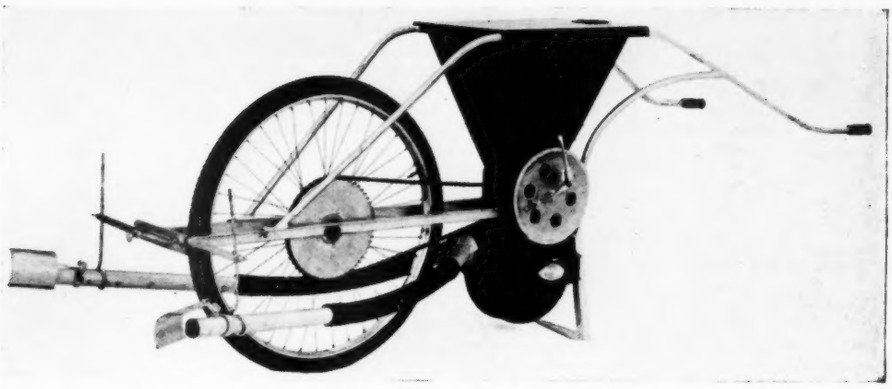


The new Massey Harris No. 780 self-propelled 12 ft. combine harvester

Skyhi hydraulic loader and manure fork. Tractor hydraulic controls are used for raising and lowering

Dorman 20-gal. tractor-mounted low volume sprayer—a new machine

Allman low-reading speedometer, fitted to front wheel of tractor



The new Allman 'Pestmaster Minor' (push model) duster

II) is powered by a 20-h.p. Armstrong diesel engine and capable of a bale output of up to 8 tons per hour. Other exhibits worthy of particular mention include: (*a*) the 'Quick-spreader' land-driven manure spreader of 35 cwt. capacity suitable for the farmer whose tractor has no power take-off shaft and for the smaller farming unit; (*b*) the power-driven 'Evenspreader' manure spreader, 2 tons capacity, operated by one man, which shreds and spreads farmyard manure; (*c*) the 'Sweep-lift' crop collector; (*d*) the 'Conveyall' loader; (*e*) a range of 'Classic' disc ploughs; (*f*) combined beet harvester and (*g*) a range of cow-house equipment.

The stand of **Skyhi Ltd.** (Stand No. 13) will show Skyhi hydraulic loaders fitted to the new Fordson Major tractor and the Nuffield tractor. The loader, comprising subframe, main lifting arm and two balanced hydraulic rams, can also be fitted to the Ferguson, Farmall and David Brown tractors. Raising and lowering, together with the tipping of the implements, are controlled from the driver's seat. The range of Skyhi implements which interchange for fitting to the end of the lifting arm includes shovel, manure fork, beet fork, jib, scraper blade, green crop loader fork and hay sweep. The Skyhi-McConnel hedger will be exhibited. Also to be on view is the Skyhi heavy-duty loader with extra large shovel of 1½ cu. yd. capacity, driven by the new Fordson industrial power unit and with hydraulic system controlled from the driver's seat. Implements include three sizes of shovels, beet fork, scraper blade, also digger teeth and crane hook. A unique feature is that the implements are returned to normal position hydraulically.

The three loaders on the stand will be shown in actual operation.

General agricultural machinery

A wide variety of cultivation implements will be shown by Messrs. **Ransomes, Sims & Jefferies Ltd.** (Stands Nos. 85 and 101), including seven mounted and two trailing ploughs, a cultivator and disc harrow. The 'M.G.5' tractor will be on show, also the Mark IV 'Crop-guard' high-volume sprayer, mounted model, and the 'Peanut Minor' picker driven by electric motor (export only). Two of the mounted ploughs, the two-furrow 'T.S. 54B' and three-furrow 'T.S. 59,' are for the export market only and have the 'D.M.D.' general-purpose digging body built on a pressed-steel bottom and fitted with a steel landside share.

The exhibits of Messrs. **Geo. W. King Ltd.** (Stand No. 22) will comprise examples of the King range of tubular steel cattle and pig pen equipment. A complete range of pneumatic grain-conveying and drying equipment, both pressure and suction systems, will be shown, including a static suction plant capable of a throughput of 4 tons an hour. Examples of electric drying equipment will be shown, also a system of drying, making use of the waste heat obtained from a diesel engine. Working examples of the 'MyTeMin' electric pulley block and 'MyTeMin' sack hoist will be on view together with 'Ropelock' hand-operated pulley blocks, examples of sliding door gear, binder canvases and elevator belts, 'Super-track' overhead runway and the 'Rasspe' Mark II mid-mounted mower.

Sprayers and dusters

Messrs. **E. Allman & Co. Ltd.** and **Allman Overseas Ltd.** (Stand No. 108) report that they are increasing production of their range of spraying and dusting machinery to meet demands from home and overseas. A new machine in the duster range to be seen at Earls Court is the 'Pestmaster Minor,' mounted on one wheel, which, in addition to applying insecticidal dusts, will also apply powdered fertiliser. The outfit includes a powder hopper of approximately 28 lb. capacity and two dust outlets. Its price is £22. Allman Overseas have sent several of these machines abroad, including Brazil, British West Indies and Syria, where encouraging reports of their performance have been received.

The Allman low-reading tractor speedometer which was shown at the Smithfield Show last year can now be supplied with metric readings. Other exhibits at this stand will include the 'Genimec' spray rig, Universal sprayer '120' and 'Midget' engine-driven knapsack duster.

A wide range of spraying machines is promised on the stand of Messrs. **Cooper, Pegler & Co. Ltd.** (Stand No. 112). Included will be the 'Hormover' low-volume tractor-mounted sprayer, having a 44-gal. tank and a 28-ft. spray boom fitted with 14 fan spray nozzles. With this boom 5 to 9 gal. per acre can be applied.

The 'Renovex' is a machine similar to the familiar 'Sapom,' and fitted with rubber diaphragm pumps driven by cams on the axle.

The 1953 range of sprayers made by the **Dorman Sprayer Co. Ltd.** (Stand No. 189) are nearly all new machines or embody new features; these were shown recently at a pre-Smithfield Show demonstration.

The 250-gal. high- and low-volume sprayer (£526 15s.) has been fitted with a pump of greatly increased capacity, enabling the spray boom width to be increased to 30 ft., and applications of 100 gal. an acre can be obtained at 4 m.p.h. A flat top tank is now fitted, a level gauge is provided at the front of the machine and the drum wash has been improved.

The tank capacity of the 100-gal. high- and low-volume sprayer has been increased to 150 gal.; the price remains at £280.

A new introduction to the Dorman range is the 20-gal. tractor-mounted low-volume sprayer with rear-mounted spray bar, sprung to eliminate damage through striking obstructions; another innovation is the protection of the tank by a sprayed coating of zinc. This sprayer is priced at £48.

A number of new developments in dusting and spraying machinery design will be shown for the first time by Messrs. **Drake and Fletcher Ltd.** (Stand No. 56). One new venture is a machine, named the 'Mistejecta,' capable of spraying both liquid and powdered insecticides and fungicides to heights of 80 to 100 ft. or horizontally to 200 ft. or more, plus drift. This is an export machine designed for combating fungi and pests of rubber, tea, etc., and locusts. The machine is portable for short distances by hand, such as the slopes of hill tea estates, and is also suitable for mounting on wheeled transport. The engine unit is a 10-h.p. Ford and output of the spray pump ranges from 620 gal. per hour at 30 lb./sq. in. to 560 gal. per hour at 60 lb./sq. in. The spray boom allows adjustment of output *per nozzle* from 6. gal. per hour to 78 gal. per hour.

Other new items include the 'Dustejecta Minor,' a lighter version of the old 'Dustejecta,' carried by two men instead of four, a similar machine adapted for tractor mounting on the three-point linkage, a hand charge pump for charging knapsack sprayers in batteries with liquid or air (£18), a knapsack trolley, tractor-mounted model of the 'L.O.' estate sprayer for the Ransome 'M.G.5' tractor, and new mistifier mounted and trailer crop sprayers for high and low volumes.

The **Four Oaks Spraying Machine Co. Ltd.** (Stand No. 237) will show for the first time the new 'Universal' machine. This is a mobile all-purpose pump suitable for spraying, whitewashing and creosoting. The pump unit is the Four Oaks 'Wizard' pump, operated by hand and mounted on the two-wheel 'Mobiliser Truck.' A special unspillable container with tap can be supplied for use as a water carrier on the truck; similarly, a black container is supplied for creosoting, and a grid is available for carrying large sacks on the truck. Price of the 'Universal' for all purposes except as a water carrier is £15 10s.

Universal Crop Protection Ltd. (Stand No. 208) will be showing two of their latest designs of mistblowing spraying machines—the 'Whirlwind Mistblower' and the 'Whirlwind Master.' Both these machines were described in WORLD CROPS (4, 10, p. 348. October 1952).

They are designed for use in orchards and are already employed in considerable numbers in orchards in Holland and Belgium. It is found that by their use spraying can be carried out at a rate of only 25 gal. of liquid per acre and that a considerable saving in water haulage and chemicals can be obtained.

Chemicals

Shell Chemicals Ltd. (Stand No. 263) are featuring their weedkillers and insecticides with particular emphasis on weedkillers 'M,' 'D' and 'B' and 'Arkotine' miscible DDT.

Shell 'M' is an MCPA product available as a liquid or as a dust (1% and 2%) for the control of weeds in cereals, linseed, flax and grassland; it may be applied with high- or low-volume spraying machines and with any good fertiliser distributor in the case of the dusts. Shell 'D' is a 2, 4-D liquid product for the control of weeds in grassland and cereals. It may be applied with high- or low-volume machines. Shell 'B' is a selective weedkiller containing 2 lb. per gallon of di-nitro secondary butyl phenol, as the ammonium salt of DNBP, for the control of weeds in peas, lucerne, sainfoin, field beans, clover and seeds leys. It is applied at 4 to 8 pints per acre in 50 to 100 gal. of water. 'A' is a miscible DDT product containing an activator which greatly increases the killing power of the DDT.

Stationary equipment

Crushing and grinding units will be on show on the stand of Messrs. **Christy and Norris Ltd.** (Stand No. 20). Both the electric and engine-driven models of the 3-h.p. 'Essex Major' hammer mill will be available for inspection. It is stated that this machine can produce, for example, barley meal at the rate of 2 to 2½ cwt./hr. using a 3.05-mm. (⅛-in.) screen and 1¼ to 1½ cwt./hr. using a 1.6-mm. (1/16-in.) screen. The price of the 'Essex Major' is £55 12s. 6d.

A larger unit is the 'Briton' grinding outfit (10 h.p.), which gives an output approximately three times that of the 'Essex Major.' This model will be exhibited with built-in motor, cyclone with two-way sacking spout, valves and clasps, suction feed for grain, and tray for feeding straw. The price of this unit is £245 16s.

Messrs. **Mitchell, Colman & Co. Ltd.** (Stand No. 67), specialists in grain handling and fodder preparation, will show a full range of their products, including the 'Dryvent' system of grain drying and storing, the 'Tornado' portable grain blower and the 'Spirolift' pick-up grain loader. The 'Petkus' range of seed cleaners and graders with throughputs of 1 to 2 tons per hour will be exhibited, also a new 'M.C.' straw chopper to fit the Massey-Harris 726 combine harvester, as well as the 'M.C.' forage harvester attachment. Another new implement introduced by this firm is the 'H.G.' grass tedder, mounted at the rear of tractor so that it deals with the swath cut by the side-mounted cutter bar of the mower during the previous circuit around the field.

The oil-fired Nu-Way crop drier will be shown by **Nu-Way Heating Plants Ltd.** (Stand No. 29). This was primarily designed to dry grain and seeds, etc., in sacks or on trays, fuel cost in the U.K. averaging 2s. per ton dried. One of these driers was exhibited at the Nairobi show earlier this year, when it was reported as having received an enthusiastic reception, and a number of driers are being shipped out as a result.

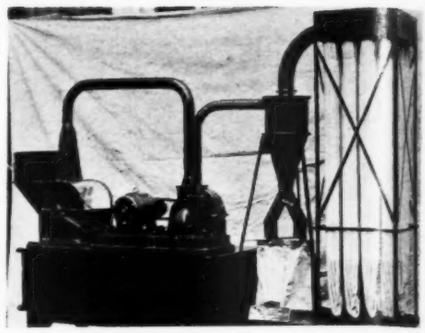
The drier has also been successfully employed for rubber drying, whilst larger driers built on the same principle are used for drying a range of materials from hops and sorghum to flock, china clay, etc. The manufacturers report that the driers can be driven by new or existing engines and, where possible, pulleys to provide the correct speed are included. The drier sells for £268 in the United Kingdom.

A new hammer mill primarily designed for American and Canadian markets and capable of grinding 2 tons of oats into cattle feed per hour is to be shown by **Scottish Mechanical Light Industries Ltd.** (Stand No. 65).

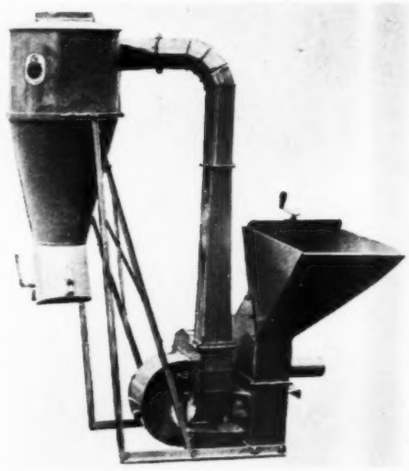
Designed for 25-h.p. to 40-h.p. tractor, diesel or electric drive, the new model, called the 'Two Tonner,' has a 50% higher capacity than the ScotMec 'Powerful' hammer mill. A range of 12 screens, from as fine as 0.0235-in. perforation (grinding for human consumption) to the largest size with 1¾-in. holes, permits any grain or roughage to be ground to any fineness. A combined chute-hopper with 'micro' feed gate allows the flow of grain to be accurately regulated so that, once set, the maximum rate of grind is maintained without overloading the power unit. The bulk feed top of the 'Two Tonner,' extending to a width of 13 in., allows full use to be made of the grinding capacity for sheaves, dried grass, corn-on-the-cob and other roughage.

To minimise export freight charges, all ScotMec mills have been designed for 'nesting,' so that crates are reduced to less than half the usual size. The ScotMec tractor-mounted hammer mill, complete with cyclone, support frame, husk ejector and all accessories, will be on show packed in an export crate of 1 cu. ton. capacity.

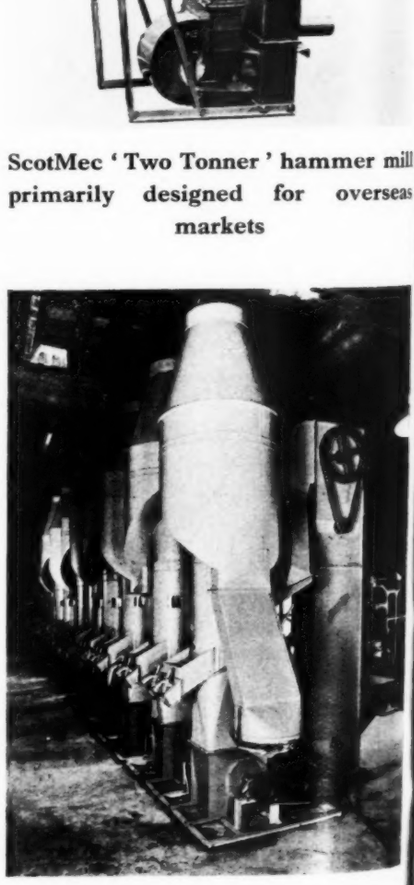
The new ScotMec grain blower will also be shown and demonstrated. Four models of the rear-mounted mobile hammer mill will also be shown—a blue unit for the old or new Fordson Major, an orange unit for the Nuffield 'Universal,' a red unit for the David Brown 'Cropmaster' (all officially approved by the respective



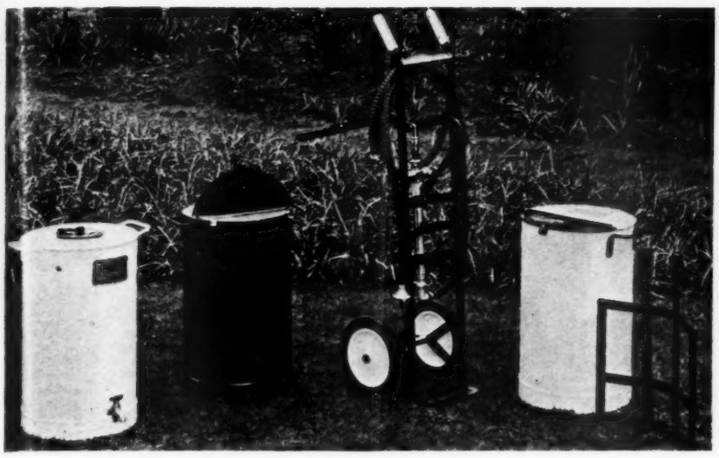
Model of the Christy and Norris dried grass grinding unit



ScotMec 'Two Tonner' hammer mill primarily designed for overseas markets



'Scientaire' pneumatic pre-cleaners for combined cereals, pulses and seed crops



The Four Oaks 'Universal' spraying machine. The black container is supplied for creosoting; the water carrier is on the extreme left

tractor companies), whilst the grey unit is the Ferguson mobile mill.

Being shown and demonstrated for the first time in Great Britain are a number of grain and seed separators by Messrs. **T. R. Walker** (Stand No. 187), who are sole concessionaires for the Swedish firm of A/B Krarnmaskiner, of Malmo. The ' Kaybee ' table separator is one of these machines, made in nine sizes having capacities ranging from 700 to 9,000 kilos per hour. It separates different kinds of seed grain from each other, removes wild radish, garlic, damaged and germinated grains, wild oats, etc. The No. 7 size machine has 36 compartments in three tiers and is driven by a built-in geared electric motor of 2.2 h.p.

A general-purpose grain and seed separator, also to be shown for the first time in Great Britain, is the ' Kaybee ' general separator, made in 20 sizes for capacities ranging from 1 ton to 100 tons per hour. The No. 10 size, for instance, has a sieve width of 3 ft. 3½ in. and a sieve inclination of 15°, with a three-sieve system having automatic lengthwise brush cleaning. Fans for air separation are enclosed on the head and tail ends of the machine.

The ' Kaybee ' blue velvet small feed separator (also being shown for the first time in Britain) is used for seeds of clover, lucerne, rape, turnip and other brassicae, grass seeds, etc.

A pneumatic pre-cleaner already known in this country is the ' Scientaire ' for combined cereals, pulses and seeds. This is a self-contained unit with feeding-on hopper, elevator, feed control slide, twin sacking-off spouts, self-contained dust-collecting unit and driven by a 36-h.p. electric motor with variable speed of from 1,630 r.p.m. to 594 r.p.m.

Other equipment which T. R. Walker will show includes a vacuum seed counter, patented infra-red moisture testers, plant for cleaning and grading small lots of seed as from trial plots and the ' Kaybee ' Type K hammer mill.

A wide variety of farm equipment and accessories will be seen on the stand of Messrs. **Wolseley Sheep Shearing Machine Co. Ltd.** (Stand No. 148). A full display of electric fencers and strip grazing equipment will be exhibited; also Wolseley 9-ft., 12-ft. and 18-ft. elevators, small horse-power stationary engines, the famous Radio Ferret and other items of interest to the stock farmer.

Miscellaneous

3½ Gal. Knapsack Sprayer

Spraying two rows of potatoes, both under and on top of the haulm, at the same time from a knapsack sprayer can be achieved by using a swivel nozzle with two fine caps as fitted to the Dron-Wal knapsack sprayer, made by the Philip B. Waldron Co. The outfit includes a 3½ gal. container, 39 in. of hose, strainer and swivel nozzle with two fine caps and one blind cap. The sprayer is operated by a diaphragm pump. Gross weight is 256 lb.

New Rear-End Loader

A new loader, fitted with a patented lifting device and designed for operation by the three-point linkage, was shown for the first time recently by Whitlock Bros., Ltd., of Great Yeldham, Essex (see p. 427).

At the demonstration it was making a good job, both loading manure from the heap and from yards into manure spreaders and low loading trailers, often working in confined spaces and under low roofs. The manure bucket, which is tipped by a cord from the tractor driver's seat, is designed for loads of up to 3 cwt. and by having the loader at the rear greater adhesion is given to the tractor drive wheels. By removal of two bolts the manure bucket can be replaced with a bale- or sack-loading attachment.

The loader is priced at £14 5s. od., the manure bucket £7 5s. od., the sack-loading attachment £2 17s. 6d. and the bale grab £2 6s. od.

The David Brown Companies

The David Brown Companies have recently acquired the first-floor suite of 96 Piccadilly, London, W.1 as their new London headquarters.

For the time being the London Office of David Brown Tractors Ltd., will remain at 49-50 Avenue Chambers, Vernon Place, Southampton Row, London, W.C.1, but this will be transferred about the end of the year.

WORLD CROPS

OUR NEXT ISSUE will be the first number of Volume V and will contain a **Review of World Agricultural Production in 1952.** L. D. Sardone writes on the **Australian Wheat Crop** and John Grindrod on the **Mechanisation of Agriculture in India.** Continuing the series ' Industry's Contribution to Agricultural Research,' we hope this month to include a contribution from Dr. W. E. Ripper, managing director of **Pest Control Ltd.** Other articles and regular features, including a report of the **Smithfield Show,** will also appear in the January 1953 issue.

New Fertiliser Factory

A new factory premises for the manufacture of special manures for the horticultural market in South-East England has recently been bought by Messrs. Vitax Ltd. The factory, only two years old, is on the Farnham Trading Estate, Farnham, Surrey, and it is hoped to be in operation early in the New Year, thus lightening production at the Company's two main factories at Burscough Bridge, Lancashire.

Technical News

In the current (December) issue of our contemporary, *Food Manufacture*, there is included an article entitled ' Fats and New Zealand's Economy ' by F. B. Shorland, John Grindrod writes on ' Excavation for Toronto's New Subway ' in *Muck Shifter and Public Works Digest*. 'A Modern Approach to Chemical Engineering Research is the title of an article by Dr. J. M. Coulson, M.A., Ph.D., in *Chemical and Process Engineering*. In *Textile Industries and Fibres* there is a ' Review of Coir Fibre ' by John Hudson.

B.S.I. 1952 Year Book

The British Standards Institution announce that their 1952 year book has now been published and contains a complete list of the 1,800 British Standards current at March 31, 1952. Particulars of the membership of the General Council and of the Institution's Divisional Councils and Industry Standard Committees are also given.

WORLD CROP REPORTS

SOUTH AFRICA

(From our Cape Town Correspondent)

Sugar expectations. Most sugar producing areas in Natal have received good rains recently. These rains are not expected to add materially to the growth of cane which is to be cut this season, and thus to the tonnages available for crushing, but they will prevent deterioration in the quality of the cane before cutting takes place. Plantings that should reach maturity in time for the 1953-54 cutting season are reported to be in good condition and they have benefited considerably as a result of the recent rains. Full-scale cutting is generally in progress in the industry. Early deliveries of cane to the mills, made by growers in an effort to alleviate the shortage of sugar in the Union, enabled 19,769 tons of sugar to be produced early in the new season. The effects of droughts upon this year's yield of cane are evident in an estimate of 563,000 tons for the 1952-53 output of sugar. As this figure is only slightly above the disappointing 1951-52 result of 532,505 tons and well below the preceding year's record of 685,798 tons, sugar rationing will thus have to continue.

Turkish tobacco. The prospects for the Turkish tobacco industry were quite favourable, the chairman told the 40th annual general meeting of the Cape Western Province Tobacco Growers' Co-Operative Society in Paarl recently. The local tobacco factories were still using a considerable amount of Turkish tobacco and it was possible that they might purchase more, absorbing most of the local production.

ISRAEL

Citrus export drop. A 12% drop in the export of citrus fruit and a 3% decrease in the total crop was noted for the year 1951-52, it was announced in Jerusalem by the Central Bureau of Statistics and Economic Research.

This year's yield was 8,025,000 crates, of which 3,700,000 crates (46% of the crop) were exported. Last year's crop was 8,300,000 crates.

A breakdown of this year's crop shows that 6,708,000 crates (84%) were oranges, 1,136,000 crates (14%) grapefruit, and 181,000 crates (2%) lemons. Compared to last year's output, the yield of oranges dropped by 3% and that of grapefruit by 8%.

TURKEY

Favourable 1952-53 cotton outlook. Official estimates of the 1952-53 cotton production in Turkey are not yet available, but unofficial estimates indicate a crop of about 735,000 bales (500 lb. gross), according to the American Agricultural Attache, Ankara. This compares with 643,000 bales in 1951-52.

The output of cotton yarn and cloth in Turkey continues to increase as new plant facilities are being added. Consumption of raw cotton during 1951-52 totalled about 220,000 bales, about 23,000 bales of which were used by village people for such purposes as local spinning, mattresses and upholstery. Present indications point to a further increase in consumption during the current season. Consumption during 1950-51 was estimated at 210,000 bales.

Exports during 1951-52 totalled 261,000 bales, a decline of about 100,000 bales from the preceding season. The decline in exports, together with the large 1951-52 crop, contributed to the large carry-over of 203,000 bales on July 31, 1952. In view of these large inventories and the prospective increase in production this season, it would appear that Turkey has a substantial export surplus—even if the expected increase in consumption materialises this season.

SPAIN

Cotton is expected to total 70,000 bales this year, according to a Ministry of Agriculture statement. This figure represents more than 20% of the country's present requirements and should allow imports to be reduced by 15 million dollars compared with last season.

Sugar. With a greater area under sugar beet and high yields expected this year, the sugar crop should be the heaviest on record.

Olive oil. While prospects for the olive oil crop are not so impressive, the Ministry points out that abundant stocks from last year's crop should guarantee a normal supply for home consumption.

Vegetables. On the vegetables side, there have been sufficient sowings of potatoes to maintain normal supply. The heavy stocks of chickpeas held over from last year to cover the eventuality of a poor crop will not be necessary this year, as the present crop is normal. Ministry of Agriculture authorities think that it may be convenient to export chickpeas next season.

WORLD

1952-53 wheat production. World wheat production in 1952-53 will amount to 7,150 million bushels, a record figure, according to a recent report of the International Federation of Agricultural Producers. Last year world production was estimated at 6,480 million bushels and for the pre-war average 1935-39 it was 6,000 million. Wheat production this year will be at the highest level in history in North America, in Asia and in Africa, and only a little under the previous record in Europe. The only major countries in which production will be substantially below earlier levels are the surplus producers of the Southern Hemisphere—Australia and Argentina.

Of more importance to an understanding of the world wheat position however, IFAP says, is the relation of world import requirement to wheat available for export. Importing countries, because of their generally good crops, will probably require less wheat from exporting countries than in recent years when they have taken over 900 million bushels annually, the international farm organisation believes. One exception to the rule of good crops, however, is India, where the 1952 wheat crop is below average and where rice supplies are far short of needs.

The IFAP says it appears that Canada and the United States will together have over 1,500 million bushels available for export. In 1952-53, total import requirements cannot be expected to exceed 900 million and there will be considerable supplies available from other exporting countries (*e.g.*, Australia, Turkey and probably Argentina). It must, therefore, be concluded, IFAP says, that a large percentage—perhaps as much as one-half—of the supplies of the United States and Canada available for export during 1952-53 will have to be carried into the 1953-54 season.

HUNGARY

High cotton yield. Despite unfavourable weather, the 1952 Hungarian cotton crop has yielded an average of 550 lb. per acre, stated Mr. Ferenc Erdei, Minister of Agriculture, speaking to a conference of agricultural experts at Budapest.

Organised experiments to grow cotton in Hungary began in 1948, when 28 acres were planted with seeds imported from the Soviet Union and Bulgaria. The area was increased to 900 acres in 1949, 14,000 acres in 1950, and 141,000 acres in 1951. The plant is a short-staple variety.

WORLD CROPS INDEX

VOL. IV • 1952

A

Abaca cultivation (*ed*) 399
Abayan Delta (*ed*) 400
Acaricide against red spider . . . 319
'Acrodel' insecticide against locusts . 349
Advances
  in Agronomy (*br*) 250
  in Genetics, Vol. IV (*br*) . . . 147
Aegian tobaccos 312
Aerial
  desiccation experiments . . . 313
  mapping in the East 257
  surveying (*corr*) 78
  surveys of seaweed 405
Aerosol dispersal of insecticides . . 347
Aerosols 337
Africa, soil erosion in (*ed*) . . . 122
African
  erosion control (*ed*) 122
  problems (*ed*) 363
  resettlement (*ed*) 262
  soils, conference 104
Africa's agricultural production . . 8
Agricultural
  aircraft, an (*corr*) 78
  chemicals (*ed*) 365
  developments in British Colonial Africa 273
  Development in Surinam, *by D. H. Grist* 351
  engineering achievements . . . 19
  Problems of Pakistan, Some, *by S. J. Wright, M.A.* 23
  research in the British Colonial Dependencies 22
  statistics (*ed*) 124
Agriculture and Economic Progress (*br*) . 191
Aldrin and Dieldrin 73, 272
Alginates from seaweed 406
Allman & Co., E. (*fm*) 253
Amazon and cocoa (*ed*) 399
American
  Agriculture (*br*) 323
  farming (*ed*) 43
  Fertiliser Practice and Problems, *by E. M. Crowther* 211
  mechanical stonepicker (*fm*) . . 291
  National Agricultural Chemicals Association 388
  tobacco, types 241
  Tomato Yearbook (*br*) 295
Ammoniacal liquor as a fertiliser (*ed*) . 2
Ammonium citrate test in U.S. . . 213
Amos memorial lecture 37
Anglo-American Council on Productivity 9
Anglo-Egyptian Sudan
  cultivation in 16
  irrigation in 51
Anhydrous ammonia 212
Animal
  feeding (*ed*) 195
  pests, their control 379
Anomaly of Systox, *by Dr. G. S. Hartley* (*res dev*) 397
Antestia bugs in Kenya 412
Antibiotic rejects for agriculture (*ed*) . 228
Antibiotics
  and agriculture (*res dev*) . . . 293
  development of (*ed*) 195
Apples in storage (*res dev*) . . . 425
Application of Electronics to the Cleaning of Agricultural Products, The, *by D. M. Tombs, M.Sc., D.I.C., A.M.I.E.E.* . 422
Approved crop protection products (*ed*) . 298

Editorial Comment (*ed*); Research Developments (*res dev*); New Books (*br*); World Crop Reports (*wcr*); Correspondence (*corr*); Farm Machinery (*fm*).

Argentina
  pessimistic crop prospects (*wcr*) . . 42
  promising rice crop (*wcr*) . . . 296
  tobacco (*wcr*) 259
  wheat, linseed and sunflower harvests (*wcr*) 120
Argentine
  ants in N.S.W. (*res dev*) . . . 258
  grain production and storage in . . 167
  tobacco 409
Arid zone research 107
Artificial Light and Horticulture, *by E. J. H. van Sluis* 161
Arwell application machinery (*fm*) . . 116
Ascension Island, soilless cultivation on . 202
Ashmuni cotton 284
Aspects of British Agricultural Law, *by G. B. Masefield, M.A., A.I.C.T.A.*
  Part I—Irrigation 285
  Part II—Inspection and Grading . 313
  Part III—Crop Controls . . 357
Atomic energy possibilities . . . 370
Auster autocars for Sudan cotton spraying 174
Australia
  development in northern territory . 39
  drought in (*ed*) 226
  increasing rice cultivation (*wcr*) . . 41
  jute prospects (*wcr*) 119
  linseed (*wcr*) 296
  tobacco 240
  wheat (*wcr*) 296
Australian
  Farmall production (*fm*) . . . 221
  farmers to grow more wheat . . 373
  rice 412
  (*wcr*) 362
Austria
  land reclamation in 207
  1951 sugar beet (*wcr*) . . . 192
Austrian
  crops (*wcr*) 398
  production of ammonium nitrate of lime 14

B

Bacterial Plant Pathogens, Manual of (*br*) 191
Bafra Turkish tobacco 312
Bahamas, soilless cultivation in . . 202
Baker, T., & Sons, Ltd. (*fm*) . . 253
Baluchistan, successful cotton irrigation . 112
Banana breeding 409
Bananas and Manila Hemp, *by N. W. Simmonds, M.A., A.I.C.T.A., F.L.S.* . 407
Barbados, agricultural law in . . . 286
Base Exchange in Soils, *by E. W. Russell, Ph.D., M.A.* 145
Battelle Institute 279
Bayer Agriculture Ltd. 95
Bees and pollination (*res dev*) . . . 218
Belgian tobacco (*wcr*) 296
Berk & Co., F. W., research centre . . 208
Berri co-operative packing union . . 292
BHC as derris substitute 11
B.I.F. 1952. 222
Bin
  drying 187
  ventilation 187
Biological control, research on (*res dev*) . 32
Birthday honours 255
Black pepper crop, India (*wcr*) . . 120
Black pod disease 373
Blast spraying 341
Blight
  fire (*ed*) 228
  halo (*ed*) 228
Blister blight, wet and dry control . . 345
B.O.E. & C.C. sales director on tour . 186
Boll weevil, Venezuelan measures against 63
Boom, spring type (*fm*) 393
Botanical exploration (*ed*) . . . 399
Botany of the Sugar Cane (*br*) . . 295
Brazil
  agricultural production, 1951 (*wcr*) . 224
  Carnauba wax (*wcr*) . . . 120
  importance of tobacco (*wcr*) . . 120
  1951-52 cotton estimate (*wcr*) . . 192
  smaller rice surplus (*wcr*) . . . 156
  tobacco 231
  to build tractors (*fm*) . . . 393
Brazilian
  cotton picker (*fm*) 361
  development (*ed*) 3
  tobacco 238
Breeding rice (*ed*) 366
Brigadier Fletcher's tour (*fm*) . . 116
British
  agricultural law 286
  Association (*ed*) 363
  meeting 387
  East Africa, tobacco (*wcr*) . . . 259
  prospects (*wcr*) 224
  farm mechanisation (*ed*) . . . 333
  farm prices (*ed*) 193
  Guiana, agricultural law . . . 286
  better rice crop (*wcr*) . . . 156
  1951 152
  meat, development of . . . 74
  Standards Institution (*ed*) . . . 262
  tobacco (*ed*) 123
  West Indies, sugar statistics (*wcr*) . 120
Brown, David
  cropmaster (*fm*) 222
  Tractors Ltd. (*fm*) 253
Budget, British (*ed*) 157
B.S.I. 1952 Yearbook 431
Buenos Aires grain elevator . . . 169
Bulk sampling of produce . . . 314
Burma
  rice production up (*wcr*) . . . 156
  tobacco 231
Bushwacker land clearer . . . 329

C

Calcium arsenate that clings . . . 426
Canada
  tobacco 230
  (*wcr*) 260
Canadian spraying 277
Cane breeding 220
Canning fruit (*ed*) 298
Cation exchange in soils . . . 145
Caterpillar
  D.8 tractor (*fm*) 115
  personnel changes (*fm*) . . . 116
  production expanding (*fm*) . . . 79
Cattle cake from Swedish oilseeds . . 303
C.D.C. and irrigation scheme in Gambia . 136
Census on agriculture 386
Central
  Coconut Committee 110
  tractor organisation of India . . 109
Cereal sowings in France (*wcr*) . . 192

Cereals
conference (*ed*) 226
in Edinburgh 216, 256
Ceylon
low-volume spraying in 349
sugar (*ed*) 261
tea 372
and soil erosion 265
protection 343
Ceylon's Prime Minister, death of (*ed*) . 157
Changes in East Africa (*ed*) . . . 363
Chelsea Flower Show 256
Chemical
additives (*ed*) 334
pest control (*ed*) 331
similarities between insecticides (*res dev*) 153
soil conditioners (*ed*) 262
supplies in Spain 309
Chemicals
from seaweed 406
in agriculture (*ed*) 365
Chile's expansion programme . . 356
China's Crops, *by John Cardew* . . 268
China, tobacco crop (*wcr*) . . . 259
Chlorination of terpene . . . 377
Christmas and New Year . . . 66
Cider and fruit juices 386
Cigars from Jamaica 239
Citrus
crops in Spain 308
exports, Israel (*wcr*) 432
virus decline disease of . . . 64
Clean Crops Ltd. (*fm*) 253
Clifford Aero & Auto Ltd. (*fm*) . . 252
Clove diseases (*ed*) 299
CMU, a new herbicide (*res dev*) . . 293
Cocoa
coffee and tea, economics of . . 111
expedition 373
in the Amazon (*ed*) 399
in the Gold Coast (*ed*) . . 83, 225
in Nigeria (*wcr*) 398
Mexican crop (*wcr*) 81
trials in Zanzibar 412
Coffee
in India (*wcr*) 362
production down in Guatemala (*wcr*) . 82
tea and cocoa, economics of . . 111
tercentenary (*ed*) 158
Trade Association (*ed*) . . . 159
Collectivised agricultural development in the U.S.S.R. 108
Colombo
plan (*ed*) 366
exhibition 94
Colonial
Agricultural Machinery Advisory Committee (*fm*) 80
Dependencies, agricultural research in . 22
development (*ed*) 227
mechanisation 80
Coloured light, effect on plant growth . 163
Columbia Basin Irrigation Project, *by John Grindrod, B.A.(Com.)* . . 383
Combined drilling and fertilising . . 149
Commando Major (*fm*) 328
Commonwealth
cotton (*ed*) 298
products map 412
sugar (*ed*) 83
Communist agriculture in China . . 268
Compost from town refuse in Holland . 69
Composting vine prunings (*res dev*) . 294
Compounds 711 and 269 (*res dev*) . . 321
Controls over crop production . . 357
'Conquest of the Desert' exhibition . 280
Cooper, Pegler & Co. (*fm*) . . . 252
Copra exports in Indonesia (*wcr*) . . 120
Coral atolls, development for food production 76
Corn
husking 306
lodging, control of 75
Cornpickers used in Holland . . . 306
Cotton
breeding, Egypt 245
in China 270
in the Commonwealth (*ed*) . . . 299
crop in Hungary (*wcr*) . . . 432
in Egypt 197
estimate, Brazil 1951-52 (*wcr*) . . 192
Pakistan 119
in Greece (*wcr*) 398
growers in South Africa . . . 421
irrigation in Baluchistan . . . 112
mechanised production in U.S.A. . 175
in Mexico (*wcr*) 42
on the Orange River 170
outlook, Turkey (*wcr*) . . . 432
pests and toxaphene 378
picker in Brazil 361
picking machines 176, 317
policy in Egypt 282
rotation in Egypt 281
in South Africa (*wcr*) . . . 296
in Spain (*wcr*) 432
varieties in the Gezira . . . 102
Crawley research station, developments at 95
Crop
desiccation (*ed*) 264
drying, research on 73
Protection Congress 390
Panel's discussion on 2,4-D (*ed*) . 86
products approved (*ed*) . . . 298
Crops
and canning (*ed*) 297
dry and wet (*ed*) 121
in Rumania 380
in South Africa 170
Cub, Farmall (*fm*) 291
Cultivation of Winter Rape and Other Oil Plants in Sweden, *by G. Andersson, Ph.D.* 301
Culture of the Tea Bush, The, *by T. Eden, D.Sc., F.R.I.C.* 371
Curran, Edward (Engineering) Ltd. (*fm*) 252
Cyrenaica, wine from 75
Cyprian tobacco 241
Cyprus, agricultural law . . . 286

D

Dairy Show, 1952 424
Danish grain harvest (*wcr*) . . . 398
Dashwood Engineering Co.'s push hoe (*fm*) 20
David Brown Co.,
price reductions (*fm*) 329
cropmaster and Howard rotavator (*fm*) 222
DD and Shell 174
DDT
airlift 382
and the older insecticides . . . 118
formulations 353
Decline of Plantation Agriculture in Indonesia, *by John E. Metcalf* . . 410
Delaney Committee (*ed*) . . . 334
Denmark
1952 crops (*wcr*) 296
sugar beet (*wcr*) 41
Desert
locust, international control measures against 271
plague 180
reclamation in Aden (*ed*) . . . 400
Desiccation
of cereals (*ed*) 264
experiments 313
Development
of chemicals (*ed*) 365
of Rotary Cultivation, *by A. C. Howard* 137
workers problems 426
Dingo control in Queensland . . 412
Dieldrin
and Aldrin 272
on peaches 337
Diesel tractor prices reduced (*fm*) . . 393
Disc plough for heavy work (*fm*) . . 185
Diseases, Pest and Hazards of Growing Citrus Crops in Spain, The, *by E. Sanchez Buedo* 308
DNBP 102
Doncaster works of International Harvester 318
Dorman Sprayer Co. (*fm*) 253
Dosages of chemicals 335
Douglas fir 284
Dragon crawler tractor production (*fm*) . 116
Drift spraying 338
Droplet
distribution 339
measurement 335
Drought in Australia (*ed*) 226
Drug crops, control of 357
Dry
rot, treatment against 96
and wet crops (*ed*) 121
Drying
of Agricultural Products, *by I. Berkovitch* 72
and air heating unit, George King Ltd. (*fm*) 21
standing crops (*ed*) 264
Dumper, 10 ft. capacity (*fm*) . . . 154
Dura in the Sudan Gezira 55
Dusting
against blister blight 346
machines 348
Dutch
Guiana's agriculture 351
developments (*ed*) 331
hybrid maize 304
International Study Centre, new (*ed*) . 122
Refuse Discovery Co. 67

E

EAAFRO (*br*) 324
Earthmoving by air (*ed*) 85
East
African enquiry (*ed*) 363
Malling, hop disease day . . . 188
lecture 37
members' day 38
new secretary for 56
Report (*br*) 324
Eastern Europe and the U.S.S.R. agriculture production survey 7
Economic Use of Fertilisers Conference . 149
Economics of coffee, tea and cocoa, the . 111
Ecuador, coffee exports, 1951 (*wcr*) . 82
Edinburgh, cereals conference in . . 216
Educating the peasant farmer . . 327
Eelworm
control 103
problems (*ed*) 401
Efficient Use of Fertilisers (*br*) . . 391
Egypt buys American pesticides . . 190
Egyptian Cotton
cultivation, production and consumption 198
development of 197
discovery of 197
Industry, The, *by C. H. Brown, B.Sc.*
Part I—Development . . . 197
Part II—Breeding and Testing . 244
Part III—Egyptian Agriculture . 281
in other countries 199
pests 200
Eindhoven, light requirement experiments at 161
Electrification in the West Canadian Provinces 105
Electrolytic processes 370
Electronic seed cleaning 422
Empire Cotton Growing Corporation (*ed*) 298
England and Wales
crop areas and yields (*wcr*) . . . 192
Farm Incomes in (*br*) 148
fruit and vegetable returns (*wcr*) . . 432
English tobacco, history of (*ed*) . . 123
Ensete varieties 407
Erosion
control (*ed*) 122
its degree of seriousness (*ed*) . . 160
Estate Forestry (*br*) 78
European
fertiliser consumption (*ed*) . . . 332
rice growing 132
tobacco 231
Europeans and East Africa (*ed*) . . 363
Excess profits levy (*ed*) 194
Expedition for cocoa 373
Expenditure in agriculture (*ed*) . . 85
Experiments in fibre cultivation (*ed*) . 399
Export control of crops . . . 358
Extracting protein from leaves . . 374
Eysvoogel Plan 351

F

FAO
- commissions, the work of . . . 61
- conference (*ed*) 1
- developments (*ed*) 263
- and the expanded technical assistance programme 164
- Grasslands Congress (*ed*) 364
- and hybrid maize (*ed*) 227
- in Libya (*ed*) 84
- meeting on fertilisers 125
- meets in Rome 13
- and Plant Protection Conventions (*ed*) . 3
- programmes of work 62
- rice commission announcement (*ed*) . 86
- reviews world agricultural production . 5
- Rome Conference (*ed*) . . 43, 60
- sampling technique (*ed*) . . . 124

FAO's
- account of upland rice 135
- ETAP (*ed*) 263
- rice breeders' working party . . 104

Far Eastern agricultural production . 8

Farm
- Electrification in the Prairie West, *by J. Grindrod, B.A.(Com.)* . . 105
- Incomes in England and Wales (*br*) . 148

Farmall
- Cub, development of . . . 318
- Super C (*fm*) 80
- Super M and Super MD (*fm*) . . 185

Farmer's Handbook (*br*) . . . 215

Fats and oils
- cheaper (*ed*) 332
- the current situation . . . 183

Ferguson
- films 188
- Harry, Ltd. (*fm*) 253
- Nigerians visit to . . . 255
- Organisation, The 419
- system publications 191

Fernhurst
- Lecture, *by Sir W. Ogg* . . . 181
- Research Station visit . . . 290

Fertiliser
- ammoniacal liquor as a (*ed*) . . 2
- consumption in Europe (*ed*) . . 332
- economics (*ed*) 121
- experiments, results of . . . 127
- factory at Sindri 94
- placement (*ed*) 124, 149
- trade (*ed*) 365
- prices and supplies in America . . 214
- refiner (*fm*) 254
- subsidies (*ed*) 122

Fertilisers
- alternative phosphatic (*ed*) . . . 85
- in America 211
- economic use of 149
- and health (*ed*) 334
- and manures in rice cultivation . . 125

Fertility maintenance in Africa . . 276

Fibre
- experiments (*ed*) 399
- industry (*ed*) 261

Fibres
- and groundnuts in China . . . 270
- Industrial (*br*) 147

Finnish grain harvest (*wcr*) . . . 362

Five-year plan in Rumania . . . 380

Flax
- area in N.W. Europe (*wcr*) . . 81
- in Australia (*wcr*) 119

Flue-cured tobacco in the world . . 260

Fluorescent light on glasshouse crops . 161

Fodder Beet (*br*) 359

Foliage spraying against manganese deficiency 382

Food
- and Agriculture Organisation . . 164
- and agriculture, world outlook for (*ed*) 1
- prices, increased to consumer (*ed*) . 4
- supplies and population (*ed*) . . 364

'Food Manufacture' silver jubilee . . 214

Ford
- demonstration 257
- Motor Co. (*fm*) 253
- price cuts 280

Fordson
- Major modified (*fm*) 328
- the new (*fm*) 18
- tractor, price increase (*fm*) . . 222
- tractor, history of 59

Forest Research Institute, The . . 413

Forestry
- and genetics 416
- and rotavation 139
- in Sweden 413
- problems (*ed*) 333

Formulations of insecticides (*res dev*) . 153

Four Oaks Spraying Co. knapsack sprayer (*fm*) 221

Four Thousand Million Mouths (*br*) . 27

Four-wheel drive tractors . . . 150

France
- afforestation in 118
- cereal sowings (*wcr*) 192
- extraction rate of wheat increased (*wcr*) 42
- grain crop prospects (*wcr*) . . . 82
- land reclamation in 206

Franklin D. Roosevelt Lake . . . 383

French
- Africa, land reclamation in . . 206
- farm machinery exports/imports (*fm*) . 154

Frost damage to citrus 310

Fruit
- (*br*) 418
- canning (*ed*) 298
- fly (*ed*) 366
- growing, development of . . . 37
- in South Australia 292
- in South Africa (*wcr*) . . . 296
- spray treatments 386

Function of agricultural shows (*ed*) . 264

Fungicide
- low-volume spraying (*ed*) . . . 159
- research 355

'Fusarex' colour film 356

Future of Phosphates, The, *by D. P. Hopkins, B.Sc., F.R.I.C.* 367

G

Gambia rice farm 136

'Gammalin' liquid concentrate . . 352

Garden tractor cheaper (*fm*) . . . 393

Genetics
- Advances in (*br*) 147
- in forestry 416

Geography
- of Hunger (*br*) 215
- section of British Association . . 387

Gezira
- developments, history of . . . 15
- pests and disease problems in the . 100
- research farm 98
- Scheme in the Anglo-Egyptian Sudan, The, *by H. Ferguson, B.Sc., N.D.A., N.D.D.*
  - Part I 15
  - Part II 50
  - Part III 98
- weather conditions in the . . . 101

Ginning mechanically harvested cotton . 178

Giza
- 47, cotton 284
- system of cotton selection . . . 245

Gold Coast
- cocoa (*ed*) 225
- outlook (*ed*) 83
- Government contracts with Pest Control Ltd. 179
- Marketing Board (*ed*) . . . 46

Grading and inspection of produce . . 313

Grain
- forecasts for Pakistan (*wcr*) . . 192
- harvest in Denmark (*wcr*) . . . 398
- in Finland (*wcr*) 362
- in Turkey (*wcr*) 398
- Production and Storage in the Argentine, *by John Grindrod, B.A.(Com.)* . 167
- in Switzerland (*wcr*) . . . 224
- in Rumania 380
- and seed drier (*fm*) 394
- storage problems 187
- transport, economy in 80

Grand Coulee Dam 383

Grass experiments (*ed*) 401

Grassland
- Improving the World's (*br*) . . 191
- irrigation 248
- research 248
- Conference, Sixth International . . 152

Grasslands Congress (*ed*) . 307, 364, 387

Grazing and grass production (*ed*) . . 401

Greece
- land reclamation in 205
- tobacco 240
- 1951 tobacco crop (*wcr*) . . . 224

Greek cotton (*wcr*) 398

Green
- Crop Conservation (*br*) . . . 323
- Crop Drying (*br*) 391
- leaves and protein production . . 374

Greenfly plague in Kenya . . . 349

Groundnuts
- and fibres in China 270
- and phosphates (*ed*) 44

Group farming in Africa . . . 274

Growth regulators 389

Guatemala, coffee production down (*wcr*) 82

'Gummosis' disease of citrus . . 310

H

Habrobracon (*ed*) 159

Hanane
- in capsule form 155
- in the Gold Coast (*ed*) . . . 83
- new treatment for swollen shoot . . 179

Hanna, Dr. 179

Haulm killer 290

Health and fertilisers (*ed*) . . . 334

Hemileia leaf disease 371

Herbicide, CMU (*res dev*) . . . 293

Hercules
- expansion 307
- Powder Company, U.S.A. . . . 377

Heterodera (*br*) 114

Hevea: 30 Years of Research in the Far East (*br*) 250

Hill
- cultivation in Indonesia . . . 411
- farming in Britain 74
- Prof. (*ed*) 364

Hillside tea and erosion . . . 267

History of IH tractor development . 316

H.M. The Queen and I.C.T.A. . . 409

Holland, visit to 40

Hop
- Diseases Day at East Malling . . 188
- pests, systemic insecticide . . . 190

Horticultural
- Congress 389
- engineering at N.I.A.E. . . . 326
- manures, new factory . . . 431

Horticulture, work on artificial light effects 161

Hosier, Dr., at I.B.A.E. meeting . . 223

Hosier's Farming System (*br*) . . 27

Hudson
- duster (*fm*) 291
- piston pump (*fm*) 291

Hungarian rice crops 134

Hungary's agricultural plans . . . 376

Hungary, 1952 cotton crop (*wcr*) . . 432

Husk worms (*ed*) 300

Hybrid
- maize (*ed*) 227
- in Holland, *by W. R. Becker* . . 304

Hybridisation of rice in India . . 140

Hydrangea, salute to the (*ed*) . . . 123

Hydraulic dumper (*fm*) . . . 154

Hydro-electric power and land use . . 93

Hydroponics 202

Hyman, Julius, Co. (*res dev*) . . . 321

I

I.B.A.E.
- and farmer-inventors 223
- meeting 40

I.C.I. and Jealott's Hill Research Station, *by A. H. Lewis, D.Sc.* . . . 247

Immunity to insecticides 388

Implement
research 420
at Fords 59
Importing
plant pests (*ed*) 300
plants, regulations for (*ed*) . . . 297
Improving the World's Grassland (*br*) . 191
India
black pepper crop (*wcr*) 120
1950-51 crop production (*wcr*) . . 41
Pakistan jute (*wcr*) 362
rice research in 140
Sindri fertiliser factory . . . 217
tobacco (*wcr*) 250
Indian
agricultural problems (*corr*) . . 397
Central Coconut Committee . . 110
Rice Research Institute . . . 140
Tobacco Committee . . . 239
coffee (*wcr*) 362
land reclamation 109
Plantation Act, The (*ed*) . . . 195
superstition (*ed*) 299
tobacco 230, 238
Indonesia, copra exports (*wcr*) . . 120
Indonesian
agriculture 410
sugar (*wcr*) 362
Industrial Fibres (*br*) 147
Industry's Contribution to Agricultural Research
No. 1—Plant Protection Ltd. and Crop Protection, *by E. Holmes, M.Sc., Ph.D., F.R.I.C.* . . . 10
No. 2—Ford Motor Co., *by S. J. Wright* 57
No. 3—Crawley Research Station . 95
No. 4—The Development of Rotary Cultivation, *by A. C. Howard* . 137
No. 5—Work of the Royal Dutch/Shell Group 171
No. 6—Tilgate Horticultural Station 208
No. 7—I.C.I. and Jealott's Hill Research Station, *by A. H. Lewis, D.Sc.* 247
No. 8—Research in Private Institutes of the U.S.A., *by K. Starr Chester* 278
No. 9—The International Harvester Company, *by H. Norris* . . 315
No. 10—The Murphy Chemical Company, *by G. A. Emery, M.A.*. 353
No. 11—The Toxaphene Story . 377
No. 12—The Ferguson Organisation, *by A. B. Lees* 419
Infiltration and percolation of rainwater . 92
Insect control and ultrasonic vibrations (*ed*) 366
Insecticidal smokes 337
Insecticides
help biological control ? (*res dev*) . . 32
resistance to (*res dev*) . . . 117
Inspection and grading of produce . . 313
Injurious Insects of the British Commonwealth (*br*) 417
Institute of Seaweed Research . . 404
Inventions, agricultural . . 223, 426
Israel's
citrus export figures (*wcr*) . . . 432
farming progress (*wcr*) . . . 224
International
Commission of Agrarian Industries . 97
Congress of Crop Protection . . 390
Harvester Company, *by H. Norris* . 315
Co. of Great Britain (*fm*) . . 252
personnel changes 251
Horticultural Congress . . . 389
Rice Commission (*ed*) . . . 86
Introducing the Farm Tractor (*br*) . . 27
Ireland, land reclamation in . . . 207
Irrigated crops in Israel . . . 210
Irrigation
investigations in the Gezira . . 100
laws in the Colonies 285
in Pakistan 24
pump (*fm*) 221
scheme in Columbia Basin . . 385
setback (*ed*) 225
I.S.M.A. Annual Meeting . . . 286
Israel, new cotton mill 13
Israel's
southern areas, development of . . 280
unirrigated crops 210
Italian sugar beet 356
Italy
land reclamation in 206
1951 production (*wcr*) . . . 42
sugar production hopes (*wcr*) . . 296
tobacco (*wcr*) 259

J

Jamaica, cigars 239
Jamaican sugar (*wcr*) 398
Japan
tobacco marketing policy . . . 231
production since the war . . 231
Java ratio, the 219
Jealott's Hill Research Station . . 247
Jute
Australian prospects (*wcr*) . . . 119
in India-Pakistan (*wcr*) . . . 362
Substitute Fibres (*br*), *by A. E. Haarer* 418

K

Karnak cotton, restriction of . . 283
Katherine-Darwin region, development in 39
Keen, Sir Bernard 307
Kenaf
(*ed*) 399
in Florida 112
and Roselle (*corr*) . . . 155, 216
Kenneth Hudson and Son (*fm*) . . 361
Kenya
and Antestia bugs 412
greenfly plague 350
King George VI (*ed*) 83
Knapsack sprayer (3½ gal.) (*fm*) . . 431
Krilium
(*ed*) 46
(*res dev*) 258
and other soil conditioners (*ed*) . . 262

L

Laboratory equipment 28
Land
clearing equipment (*fm*) . . . 328
judging contest (*ed*) 158
reclamation in India 109
by India's Central Tractor Organisation 109
under the Marshall Plan . . 205
Sierra Leone 200
in the Yorkshire Dales (*fm*) . . 935
Reform Act in India (*ed*) . . . 297
System in Palestine (*br*) . . . 322
Latin America, agricultural production in 7
Laws for produce inspection . . . 314
Leaves and protein production . . 374
Legal aspects of irrigation . . . 285
Lelydorp Plan 351
Libyan developments (*ed*) . . . 84
Light requirements of plants . . . 161
Lindane and DDT incorporated in smoke insecticide 97
Linseed in Australia (*wcr*) . . . 296
Liquid ballast for tractor tyres . . 187
Livestock at Smithfield Show . . 21
Loader, rear-end (*fm*) 431
Locust
bait (*corr*) 290
control by BHC 12
desert 271
plague in Africa and Middle East . 272
in Middle East 180
Locusts killed rapidly 349
Long Ashton Open Day . . . 386
Lord Boyd-Orr, D.S.O., F.R.S. . . 146
Lowland cultivation in Indonesia . . 411
Low-volume
fungicide spraying (*ed*) . . . 159
mist blowers 338
sprayers for orchards . . . 348
principles of 141
spraying in Ceylon 349
Lubia in the Sudan Gezira . . . 55
Lybia orders DDT 382

M

Machinery
consultant for India/Pakistan . . 319
in Rumania 381
at Smithfield (*fm*) 19
Madagascar
tobacco (*wcr*) 259
1951 tobacco crop (*wcr*) . . . 224
Magnesium for crops (*ed*) . . . 44
Maize
harvesting methods in the Netherlands 307
hybrid (*ed*) 227
hybrids in Holland 304
mechanical picking 306
in Rumania 381
Malaya
rice production (*wcr*) . . . 156
rubber production in (*ed*) . . . 2
Maleic hydrazide as a herbicide . . 190
Management
and Conservation of Vegetation in Africa (*br*) 77
in the Gezira 17
Manganese deficiency 382
Mangrove swamp reclamation for rice cultivation 129
Manila hemp 407
Manual of Bacterial Plant Pathogens (*br*). 191
Manure
and fertiliser research . . . 182
handling 420
Manures and fertilisers in rice cultivation 125
Marginal land reclamation . . . 255
Marketing schemes in West Africa (*ed*) . 45
Marshall Plan, land reclamation under . 205
Marty reversible disc plough (*fm*) . . 254
Marx Against the Peasant (*br*) . . 77
Massey-Harris School 327
McCormick
International 127-SP harvester-thresher (*fm*) 185
Super W-6 and Super WD-6 (*fm*) 185
reaper 315
McGraw-Hill move 216
McKenzie Taylor, Dr. E., appointed agronomist to Rotary Hoes Ltd. . . 186
Mealy bugs on citrus 308
Meat from the hills of Britain . . 74
Mechanical
Handling Exhibition 290
of grain in the Argentine . . 168
harvesting of cotton 176
Mechanics of Spraying, *by S. J. Zimmer* . 335
Mechanisation
in Africa 274
in Britain (*ed*) 333
in Pakistan 23
Mechanised cotton production in U.S.A. 175
Mechanising nursery work . . . 38
Mercurial compounds 208
Methane gas as tractor fuel . . . 40
Mexico
cocoa crop (*wcr*) 81
1951-52 cotton crop (*wcr*) . . . 42
Middlebreakers for cotton seedbeds . 175
Mineral Nutrition of Plants (*br*) . . 113
Ministry of Agriculture's farm price review (*ed*) 193
Mist blower characteristics . . . 338
Mitchell Colman & Co. (*fm*) . . . 253
Modern
Developments in Soil Science, *by Sir William Ogg* 181
Farm Dairy Equipment (*br*) . . 322
Modesto Agricultural Laboratory, California 173
Monsanto
chemicals, new discovery by (*ed*) . 46
licences soil conditioner formulators . 370
Mosquitos and irrigation (*ed*) . . 226
Moss control 209
Mounted disc plough 361
Mowry, Dr. David T. (*res dev*) . . 258
Muckshifting by air (*ed*) . . . 85
Murphy Chemical Company . . . 353
Musa varieties 407

N

Naming pest control products (*ed*) . . 262
Natal
  rice production in 170
  Royal Agricultural Society's Annual Show, *by A. C. Barnes* . . . 325
  sugar 170
    (*wcr*) 296
    production (*wcr*) 82
National Gardens Guild 40
Natives and forest work (*ed*) . . . 333
Neame, Thomas, Amos Memorial Lecture 37
Near East
  agricultural production 8
  wheat (*ed*) 263
Nematodes (*ed*) 401
Netherlands
  agricultural situation 67
  land reclamation in 205
  soil improvement in 67
New
  Fordson Major 257
    successes 155
  Forest crops 35
    future plans for 36
    reclamation in 33
  Guinea rice cultivation (*wcr*) . . 41
  Holland fertiliser spreader-cum-seeder 254
  insecticides (*res dev*) 321
  machinery at 1952 Smithfield Show (*fm*) 427
  publications 425
  South Wales, rice failure (*wcr*) . . 296
  Summer Ovicide for Red Spider, *by G. A. Emery* 319
  systemic insecticide (*res dev*) . . 350
  Year Honours 56
  Zealand fertiliser plans 178
  tobacco 231
    production (*wcr*) . . . 296
Next Year Country (*br*) 295
N.I.A.E. open day 222, 326
Nigerian cocoa (*wcr*) 398
1951 general agricultural outlook . . 5
Nitric acid process 368
North America, agricultural production of 5
Northern Rhodesia, tobacco (*wcr*) . . 259
Norwegian fertiliser factory (*fm*) . . 394
Nozzle designs for spraying equipment . 344
Nozzles 336
Nurseryman's and Mushroom Grower's Booklet 251
Nursery work, mechanisation of . . 381
Nutrient investigations 386
N.W. Europe, flax (*wcr*) 81
Nyasaland, tobacco production (*wcr*) . 259

O

Oak Ridge Institute, agricultural symposium 188
Oceania agricultural production . . 9
OEEC on fertilisers (*ed*) . . . 332
Oil
  Co.'s agricultural research . . . 171
  Exhibition 257
  seed research (*res dev*) . . . 425
Oils
  and fats 183
    cheaper (*ed*) 332
Oilseed
  cultivation in Sweden 301
  production in Syria (*wcr*) . . . 362
Olive
  oil forecast for Tunisia (*wcr*) . . 82
    in Spain (*wcr*) 432
Oliver
  Corporation (*fm*) 252
    change 292
Open Day at Long Ashton . . . 386
Orange River cotton 170
Orchard low-volume sprayers . . 348
Organic
  manures 389
  seaweed chemicals 406
Organisation and Work of the Forest Research Institution of Sweden . . 413
Organo-
  mercurial replaces sulphur . . . 108
    for seed treatment 96
  mercury compounds 209
Overseas Food Corporation Report and Accounts for 1950-51 . . . 151
Ovicide against red spider . . . 319
Oxford Farming Conference (*ed*) . . 84

P

Pakistan
  grain forecasts (*wcr*) 192
  more rape and mustard (*wcr*) . . 224
  1952 cotton estimate (*wcr*) . . 119
  record 1951 tea output (*wcr*) . . 224
  some agricultural problems of . . 23
  wheat (*wcr*) 398
Pakistan's second rice forecast (*wcr*) . 156
Pasqua Rosee (*ed*) 158
PCPBS ovicide 320
Pea seed approval scheme . . . 40
Percolation of rainwater . . . 92
Peru, more rice grown (*wcr*) . . . 156
Pest
  control aerial demonstrations . . 223
    Ltd. demonstration . . . 255
      new chairman 146
    products, common names (*ed*) . . 262
    training 379
  control's Pestatom (*fm*) . . . 21
Pesticide
  Handbook, The (*br*) 251
  trade 388
Pests of Sudanese cotton . . . 55
Petroleum industry and agricultural research 171
Philippines, tobacco (*wcr*) . . . 260
Philippino sugar (*wcr*) 398
Phosphate shortage (*ed*) . . . 365
Phosphates
  in Agriculture (*br*) 251
  and groundnuts (*ed*) 44
Phosphatic
  fertiliser problems 367
  fertilisers (*ed*) 85
Phosphorus insecticides . . . 355
Photo-electric cells and seed sorting . 422
Photoperiodicity investigations . . 161
Phytopharmacie Congress . . . 390
Pineapple disease, treatment against . 96
Pink bollworm (*ed*) 366
Pipeline
  protection 183
    by magnesium anodes . . . 155
Piper
  hybrid variety of Sudan grass (*ed*) . 158
  new aircraft (*fm*) 115
Planned development in the Northern territories of Australia . . . 39
Plant
  Breeders of the Future (*br*) . . 114
  disease control (*ed*) 228
  growth regulator research . . . 249
  pests, imported (*ed*) 300
  Protection Conference report . . 250
    conventions (*ed*) 3
    Ltd. (*fm*) 253
      and Crop Protection, *by E. Holmes, M.Sc., Ph.D., F.R.I.C.* . . 10
    Organisation 11
Plantation
  agriculture in Indonesia . . . 410
  crops and spraying 343
Plenary meetings of FAO conference . 10
Plough research 419
Plucking tea 373
Plum curculio control 337
Point IV programme 166
Polished Ploughshare, The (*br*) . . 147
Pollination experiments (*res dev*) . . 218
Population
  and food supplies (*ed*) . . . 364
  trends (*ed*) 400
Portugal, land reclamation in . . 207
Post-war disturbances in Indonesia . 410
Potash, Palestine 32
Potato
  Harvester rewards 424
  Yearbook, The 360
Power dusters 248
Prairie West, electrification of farms in . 105
Pre-
  emergence damping off, treatment against 97
  and post-emergence sprays on cotton . 176
Press, agricultural (*ed*) 402
Prices, increased consumer (*ed*) . . 4
Principles of Low-Volume Sprayers, *by C. J. Crosbie* 141
Produce grading and inspection . . 313
Production and Marketing of Rice, The (*br*) 359
Productivity
  team (*ed*) 43
    on fruit storage 9
Progress in Mechanised Cotton Production in the U.S.A., *by Harris P. Smith* . 175
Protection of agricultural workers (*ed*) . 193
Protein
  exctraction machine 374
  Production from Green Leaves, *by N. W. Pirie, M.A., F.R.S.* . . 374
Prototype reversible plough (*fm*) . . 396
Pruning of tea 372
Publications received 392
Pumps for low-volume sprayers . . 142
Pyrites processing plant in Auckland . 178

Q

Queensland and dingo control . . 412
Quick decline disease, symptoms and control 65
Quinine, new substitute for (*ed*) . . 123

R

Rainfall
  averages in Tennessee Valley . . 91
  Watershed and Streamflow, *by Harry A. Curtis*
    Part I 47
    Part II 91
Rainmaking (*ed*) 333
Ransomes, Sims and Jefferies (*fm*) . . 252
Rape cultivation in Sweden . . . 301
R.A.S.E. silver medal 253
Rat exterminator (*res dev*) . . . 218
Readability and agricultural publications (*ed*) 402
Rear-end loader (*fm*) 431
Recent Strawberry Breeding in Scotland, *by R. D. Reid* 87
Reclaiming
  Land for Agriculture (*br*) . . . 114
  the New Forest, *by David R. Browning, N.D.A., N.D.D.* 33
Reclamation of Mangrove Swamp Areas for Rice Cultivation, *by Hector Macluskie, Dip.Agri.* 129
Red
  seaweeds 406
  spider control 284, 355
    ovicide 319
Refuse for soil improvement . . . 67
Religious observances in India (*ed*) . 299
Research
  in the Field of Tobacco Cultivation and Processing, *by John Grindrod, B.A. (Com.)* 242
  in Private Institutes of the U.S.A., *by K. Starr Chester* 278
  on tobacco, Southern Rhodesia . . 234
  in West Africa (*ed*) 46
Reseeding in Yorkshire . . . 395
Reservoir, vegational 47
Reservoirs of a watershed, natural . . 47
Resettlement
  in Africa (*ed*) 262
  at Kigezi 275
Residue problems of chemicals . . 388
Resistance to insecticides . . . 388
Reversible plough prototype . . . 396
Rhodesias, sugar and cotton, the (*wcr*) . 82
Rhodochlamys 408
Rice
  acreage increased in Peru (*wcr*) . . 156
  in Australia 412
    (*wcr*) 362

Breeders' Working Party . . . 104
British Guiana (*wcr*) 156
and Colombo plan (*ed*) . . . 366
crop, Argentina (*wcr*) . . . 296
cultivation, fertilisers and manures in . 125
mechanisation in 136
reclamation of mangrove swamp for. 129
Development Co. of British Guiana . 152
developments in Africa . . . 274
in Dutch Guiana 352
in the East (*ed*) 366
failure in New South Wales (*wcr*) . 296
forecast, 1951-52 (*wcr*) . . . 156
Pakistan (*wcr*) 156
growing in Europe 132
harvesting 421
huller and polisher (*fm*) . . . 154
hulls, new use for 132
improvement, American . . . 134
in Italy 132
manurial practices 136
in Natal 170
production in Malaya (*wcr*) . . 156
up in Burma (*wcr*). . . . 156
and rotation (*ed*) 121
rotations in 135
soil erosion 136
surplus smaller in Brazil (*wcr*) . 156
in U.S.A. (*wcr*) 398
weed control 136
world estimate (*wcr*) 81
Rock phosphate 370
Rome
Conference, the 60
FAO headquarters at . . . 13
Machinery Exhibition (*fm*) . . 79
Roselle
characteristics of 70
cultivation of 71
and Kenaf (*corr*) . . . 155, 216
a Second Jute Substitute, *by A. E. Haarer* 70
varieties of 70
Rotary
cultivation 137
Hoes appoint agronomist . . . 186
Ltd. (*fm*) 253
Gem Mark 4 (*fm*) . . . 20
subsidiary (*fm*) 79
Rotavation and rice (*ed*) . . . 121
Rothamsted
Report for 1950 (*br*) 28
for 1951 (*br*). 392
Rouelle's protein experiment. . . 374
Row-crop and rice equipment school . 327
Royal
Commission on East Africa (*ed*) . . 363
Dutch/Shell Laboratory, Amsterdam . 173
Horticultural Society of England . 389
Show attendance 289
director 409
(*ed*) 264
(*fm*) 252
1952 31
Royal visit 288
silver medal competition . . 287
visitors from overseas . . 288
R.S.A. paper on fertilisers (*ed*) . . 124
Rubber
production in Malaya (*ed*) . . . 2
world situation (*wcr*). . . . 81
Rumanian
five-year plan 380
grain 380
machinery 381
maize 381
rye. 381
Rumania's Crops, *by John Cardew* . . 380
Russian tractor (*fm*) 291
Rye in Rumania 381

S

Sabi Valley, potentialities of . . . 18
Safflower seed oil (*res dev*) . . . 425
Sakellarides cotton 244
Salination in the Netherlands (*ed*) . . 400
Samsuh Turkish tobacco . . . 312
Sand and Water Culture (*br*). . . 418
Scale insects on citrus 308
Scarcies Delta, Sierra Leone . . 129
S.C.I. Conference at Edinburgh (*ed*) . 226
Science and the Press (*ed*) . . . 402
Scientific policy (*ed*) 297
Scotmec Hammermill (*fm*) . . . 115
Scottish
Agricultural Industries Ltd., fertiliser refiner (*fm*) 254
Mechanical Light Industries Ltd. (*fm*). 253
seaweed survey methods . . . 405
Sea
inundated land reclamation . . 146
island cotton in the West Indies (*ed*) . 193
Seaweed harvesting 405
Seaweeds—A New Source of Chemicals and Food, *by F. H. Woodward, B.Sc., Ph.D., F.R.S.E.* 403
Seed
cleaning, new method . . . 422
dressings. 96
drier (*fm*) 394
spacing 420
Selected writings of N. I. Vavilov (*br*) . 113
Selective weedkillers (*res dev*) . . 76
Senanayake, death of Mr. D. S. (*ed*) . 157
Shell
agricultural research 171
appointments 251
D-D application 103
for Eelworm Control, *by J. C. Higley* 103
Shell's new marketing headquarters . 376
Shortage of scientists (*ed*) . . . 297
Shows, agricultural, and their function (*ed*) 264
Sierra Leone
land reclamation in 200
Scarcies Delta in 129
Silk and tea in China 270
Sindri fertiliser factory . . . 94, 217
Sisal prospects (*ed*) 261
Sitka
spruce 284
in the United Kingdom . . . 71
Sixth
International Grasslands Congress . 387
(*ed*) 364
session of FAO Conference . . 13
Small fruit and vegetable returns, England and Wales (*wcr*) 432
Smithfield
Show, 1951 (*ed*) 4, 19
preview, 1952 (*fm*) . . . 427
Smoke
fumigation 355
insecticide, new 97
Smokes as insecticides 337
Sodium salts in irrigation water . . 146
Softwoods introduced in Great Britain . 284
Soil
conditioner production in U.K. . . 258
conditioners sold to formulators . . 370
Conservation Society of America (*ed*) . 196
erosion in Africa (*ed*) . . . 122
in Ceylon Tea, *by R. Maclagan Gorrie, D.Sc.* 265
historical (*ed*) 160
Improvement from Town Refuse in the Netherlands, *by John Grindrod, B.A. (Com.)*. 67
Physical Conditions and Plant Growth (*br*) 359
sampling device 190
science, developments in . . . 181
Soilless Cultivation of Plants, The, *by M. A. H. Tincker and E. Johnson* . 201
Soils, base exchange in. 145
Some Agricultural Developments in British Colonial Africa, *by G. W. Nye, O.B.E., B.Sc.* 273
South
Africa, fruit (*wcr*) 296
Sugar Technologists' Association . 219
expectations (*wcr*) . . . 432
African cotton 296
growers 421
farming 237
tobacco 230
Turkish (*wcr*) 432
Australia, fruit growing in . . . 292
Pacific Commission, work on atolls . 76
Southern
France, rice production . . . 133
Rhodesia, bad season (*wcr*) . . 330
increasing native production in . 60
1952 crop prospects (*wcr*) . . 192
tea estate 373
tobacco (*wcr*) . . . 259, 296
auction sales of 234
curing of 233
cigar leaf 232
grading of. 234
types of tobacco 232
Rhodesian Tobacco Industry, *by I. H. Morten* 232
Soya
bean research in India . . . 189
beans in China. 270
Space for science (*ed*) 402
Spain
citrus hazards 308
cotton crop (*wcr*) 432
olive oil crop (*wcr*) 432
and Portugal, rice growing in . . 133
sugar crop (*wcr*) 432
vegetable crop (*wcr*) 432
Spray
droplet size 335
machinery design 393
nozzle requirements 336
Sprayers and dusters at 1952 Smithfield Show (*fm*) 427
Spraying
in Canada 277
equipment nozzles 344
problems (*ed*) 331
residues on Ceylon tea . . . 343
Spruce, Sitka, in the U.K. . . . 71
Stalinetz 80 tractor (*fm*) . . . 291
Stalk shredders in the cotton belt . . 175
Stationary equipment at 1952 Smithfield Show (*fm*) 430
Stonepicker (*fm*) 291
Storage
behaviour of apples (*res dev*) . . 425
of grain in the Argentine . . . 167
on the farm 187
water, types of 49
Strawberries
disease of 87
experiments work on . . . 88
history of in Scotland . . . 87
Strawberry stocks, testing of . . . 90
Streamflow, rainfall, differences between. 91
Streptomycin cures European foulbrood of bees (*res dev*) 425
Stripper-type cotton harvesters . . 177
Study Centre, New International Dutch (*ed*) 122
Subsidies and credits, fertiliser (*ed*) . 122
Sudan
cotton-spraying contracts . . . 174
developments in (*ed*). . . . 1
Gezira, crop husbandry in the . . 52
cultivation in the 53
grass (*ed*) 158
Sudanese cotton 53
Sudden death disease of cloves (*ed*) . 299
Sugar
beet, Denmark (*wcr*) 41
harvest, Austria (*wcr*) . . . 192
in Italy 356
production down (*wcr*) . . . 41
cane in China 270
in Ceylon (*ed*) 261
expectations, South Africa (*wcr*) . . 432
in Indonesia (*wcr*) 362
in Jamaica (*wcr*) 398
in Natal 170
(*wcr*) 296
in the Philippines (*wcr*) . . . 398
in the Rhodesias (*wcr*) . . . 82
in Spain (*wcr*) 432
industry's display at Natal Show. . 325
production in Natal (*wcr*) . . . 82
Italy (*wcr*) 296
record world crop (*wcr*) . . . 330
scheme for the Colonies (*ed*) . . 83
statistics in B.W.I. (*wcr*) . . . 120

Technologists' Association Congress . 219
world production (*wcr*) . . . 81
prospects of (*wcr*) 119
Sulphur
replacement 108
supplies 368
Superphosphate process . . . 367
Superstition and sterling in India (*ed*) . 299
Supertrac in India (*fm*) . . . 185
Swamp development in Africa . . 274
Sweden, oilseed cultivation . . . 301
Swedish
Agricultural Counsellor's award . . 205
forestry 413
Switzerland, grain production (*wcr*) . 224
Swollen shoot
capsule treatment against . . . 155
in cocoa (*ed*) 225
disease, capsule treatment . . . 179
Synergism between insecticides (*res dev*). 153
Syrian oilseed production (*wcr*) . . 362
Systemic
fungicides 189
insecticides 355
insecticide (*res dev*) 397
treatment of swollen shoot. . . 179
Systox
(*res dev*) 397
systemic insecticide (*res dev*) . . 350

T

Tea
in Asia (*wcr*) 398
in Ceylon 265, 372
coffee and cocoa, economics of . . 111
cultivation 371
estate started 373
planting 372
plucking 373
prices, London 110
production in Pakistan (*wcr*) . . 224
pruning 372
and silk in China 270
'Tea Trade and Industry' 251
Technical
Assistance Programme of UN . . 165
news . 218, 253, 290, 307, 346, 387, 431
Terpene chlorination 377
Testing machinery at N.I.A.E. . . 327
'Tetrax' 1, systemic against hop pests . 190
Thanite 377
Thatch-making machine (*fm*) . . 221
Third
Congres International de Phyto-pharmacie 188
International Congress of Crop Protection. 390
Exhibition of Farm Machinery, Rome (*fm*) 79
Thirteenth International Horticultural Congress. 389
Thornycroft vehicles for locust survey . 180
Tilgate Horticultural Station. . . . 208
Tiller ridger, Clifford Model A1/16 (*fm*). 221
Tobacco
in Argentina 409
in Belgium (*wcr*) 296
in Brazil 231
(*wcr*) 120
Brazilian 238
in Britain (*ed*) 123
British East Africa (*wcr*) . . . 224
in Burma 231
in Canada 230
in China 270
Congress of 1951 230
curing 229
the current situation 29
in Cyprus 241
in Europe 231
exporting and importing countries . 29
Farming in South Africa, *by D. F. Retief* 237
in Greece 240
(*wcr*) 224
Growing and Processing, *by John Grindrod, B.A.(Com.)* 229
in India 230, 238
industry of Turkey 311
in Japan 231
in Madagascar (*wcr*) 224
in New Zealand 231
production
Argentina 259
Brazil 259
Canada 260
China 259
East Africa 259
India 260
Italy 259
Madagascar 259
New Zealand (*wcr*) 296
Philippines 260
Southern Rhodesia (*wcr*) . . 296
U.S.A. 259
(*wcr*) 119
reflections (*ed*) 225
research 242
in Southern Rhodesia, *by F. A. Stinson* 234
in South Africa 230
types in America 241
in the U.S.A. 230
Virginian 238
white burley 238
in Yugoslavia 240
Tomato Yearbook 418
Town refuse, treatment of . . . 68
Toxaphene
Story, The 377
throughout the world . . . 379
Toxic hazards (*ed*) 193
Trace element research . . . 182
Tractor
automatic coupling 420
cabs (*fm*). 154
design by International Harvester . 315
fuel, new developments . . . 40
garden (*fm*) 393
research at Fords 58
statistics (*ed*) 364
with 12 gears (*fm*) 80
Tractors
at 1952 Smithfield Show (*fm*) . . 427
four-wheel drive 150
Trade
in Agricultural Machinery (*br*) . . 391
publications 329, 396
Training
in pest control 379
planners (*ed*) 45
Tulip fire, treatment against . . . 97
Tunisia, olive oil forecast (*wcr*) . . 82
Turkey
land reclamation in 207
mechanisation in (*fm*) . . . 116
Turkey's
cotton outlook (*wcr*) 432
tobacco industry 311
Turkish
grain harvest (*wcr*) 398
tobacco prospects, South Africa (*wcr*) . 432
training centre (*ed*) 45
Turner Manufacturing Co. Ltd. (*fm*) . 252
2,4-D and MCPA (*ed*) 86
Two new selective weedkillers (*res dev*) . 76
Tyres and their development . . 187

U

U.K. Dependencies and world food . 150
Ultrasonic vibrations and insect control (*ed*) 366
UNESCO's part in the arid zone research 107
United Nations Food and Agriculture Organisation 164
Universal Crop Protection Ltd.'s combine dusting and spraying equipment (*fm*) . 21
Untaken Harvest (*br*) 322
Upland rice, potentialities of . . . 135
Urban populations and agriculture (*ed*) . 196
U.S.A.
crop report (*wcr*) 330
1952 crop targets (*wcr*) 81
forecast, tobacco (*wcr*) 259
rice (*wcr*) 398
tobacco 230
production and exports (*wcr*) . . 119
wheat outlook (*wcr*) 362
U.S. fibre experiments (*ed*) 399
Use of the Low-Volume Mist Blower, *by J. M. Beskine, B.Sc.* 338
Useful and Ornamental Plants of Trinidad and Tobago (*br*) 360
U.S. fertiliser supply prospects . . 49
U.S.S.R., collectivised agricultural development in 108

V

Vavilov, N. I. (*ed*) 85
Vegetable
oils and fats 183
in Sweden 301
Oils and Oilseeds (*br*) . . . 417
Vegetables in Spain (*wcr*) . . . 432
Vegetative covers, influence of . . 93
Venezuelan boll-weevil campaign . . 63
Vickers VR 180 (*fm*) 222
Victoria's wheat estimate (*wcr*) . . 41
Vine prunings, composting (*res dev*) . 294
Virus
decline disease (*corr*). 216
of Citrus, *by A. F. Posnette* . . 64
origin of 66
research on citrus 64
Vitax Ltd., new factory 431
Vuilafvoer Maatschappij (VAM), work of 68

W

Wageningen method of blast spraying . 342
Warfarin (*res dev*) 218
Wartime seaweed developments . . 404
Water
cultures 201
problems in Libya (*ed*) . . . 84
storage 48
supply for rice cultivation . . . 125
Watershed and rainfall 91
Wattle industry at Natal Show . . 325
Wells, R., & Sons Ltd., Marty plough (*fm*) 254
West
Africa, agricultural development in (*ed*) 45
Indian sea island cotton (*ed*) . . 193
Western Europe, agricultural production of 6
Wet Spraying Compared with Dusting for the Control of Blister Blight on Ceylon Tea, *by J. Lamb* 345
Wheat
in Australia 373
(*wcr*) 296
estimate, 1952-53, world (*wcr*) . . 432
in Pakistan (*wcr*) 398
in the Near East (*ed*) . . . 263
outlook in U.S.A. (*wcr*) . . . 362
yields in Hungary 376
White rot of onions, control of . . 209
Whitlock managing director overseas (*fm*) 222
Wild bananas 407
Williams, Tom, with Ford Motor Co. . 186
Wind erosion investigations . . . 57
Wine from Cyrenaica 75
Winter washes for fruit trees. . . 353
Witches' broom disease in cocoa . . 373
Wolseley
price increases (*fm*) 79
range at B.I.F. (*fm*) 186
Sheep Sheering Machine Co. Ltd. (*fm*) 252
Women in agriculture 275
Wood Technology, Textbook of (*br*) . 360
Woodstock Farm. 172
World
agricultural production, 1951 . . 5
fertiliser trade (*ed*) 365
food and U.K. Dependencies . . 150
1952 sugar prospects (*wcr*). . . 119
outlook for food and agriculture, the (*ed*) 1
for tobacco 30
output of tractors (*ed*) . . . 364
rice forecast, 1951-52 (*wcr*) . . 156
outlook (*wcr*) 81

rubber situation (*wcr*) . . . 81
sugar (*wcr*) 330
beet production down (*wcr*) . . 41
outlook (*wcr*) 81
Tobacco Congress, Amsterdam . . 242
wheat production, 1952-53 (*wcr*). . 432

Y

Yeoman of England, Turner Mfg. Co. (*fm*) 20
Yugoslavian
technicians' visit (*fm*) 394
tobacco 240

Z

Zamindari in India (*ed*) 297
Zanzibar cocoa trials 412
Zuider Zee dam (*ed*) 401

AUTHOR INDEX

ANDERSSON, G., Ph.D.: The Cultivation of Winter Rape and Other Oil Plants in Sweden 301

BARNES, A. C.:
South African Sugar Technologists' Association Annual Congress . . 219
Natal Royal Agricultural Society's Annual Show 325

BECKER, W. R.: Hybrid Maize in Holland 304

BERKOVITCH, I.: Drying of Agricultural Products 72

BESKINE, J. M., B.Sc.: The Use of the Low-Volume Mist Blower . . . 338

BROWN, C. H., B.Sc.:
The Egyptian Cotton Industry
Part I 197
Part II 244
Part III 281

BROWNING, DAVID E., N.D.A., N.D.D.: Reclaiming the New Forest . . 33

BUEDO, E. SANCHEZ: The Diseases, Pests and Hazards of Growing Citrus Crops in Spain 308

CARDEW, JOHN:
China's Crops 268
Rumania's Crops 380

CHESTER, K. STARR: Research in Private Institutes of the U.S.A. . . . 278

CROSBIE, C. J.: Principles of Low-Volume Sprayers 141

CROWTHER, E. M., D.Sc., F.R.I.C.: American Fertiliser Practice and Problems 211

CURTIS, HARRY A.:
Rainfall, Watershed and Stream Flow
Part I 47
Part II 91

EDEN, T., D.Sc., F.R.I.C.: The Culture of the Tea Bush 371

EMERY, G. A.:
A New Summer Ovicide for Red Spider 319
The Murphy Chemical Company . 353

FERGUSON, H., B.Sc., N.D.A., N.D.D.: Gezira Scheme in the Anglo-Egyptian Sudan
Part I 15
Part II 50
Part III 98

GOODMAN, ALAN:
A New Systemic Insecticide (*res dev*) . 350
Antibiotics and Agriculture (*res dev*) . 293
Insecticides Help Biological Control ? (*res dev*) 32
Resistance to Insecticides (*res dev*) . 117
Streptomycin Cures European Foulbrood of Bees (*res dev*) . . . 425
Two New Insecticides (*res dev*) . . 321
Use More Bees (*res dev*) . . . 218

GRINDROD, JOHN, B.A. (Com.):
Farm Electrification in the Prairie West 105
Grain Production and Storage in the Argentine 167
Research in the Field of Tobacco Cultivation and Processing . . . 242
Soil Improvement from Town Refuse in the Netherlands 67
The Columbia Basin Irrigation Project 383
Tobacco Growing and Processing . 229

GRIST, D. H.: Agricultural Development in Surinam 351

HAARER, A. E.: Roselle—A Second Jute Substitute 70

HARTLEY, G. S.: The Anomaly of Systox (*res dev*) 397

HIGLEY, J. C.: Shell D-D for Eelworm Control 103

HOLMES, E., M.Sc., Ph.D., F.R.I.C.: Plant Protection Ltd., and Crop Protection 10

HOPKINS, D. P., B.Sc., F.R.I.C.:
The Future of Phosphates 367
Two New Selective Weedkillers (*res dev*) 76

HOWARD, A. C.: Industry's Contribution to Agricultural Research—IV. The Development of Rotary Cultivation . 137

JOHNSON, E., M.C., B.A.: The Soilless Cultivation of Plants 201

LAMB, J.: Wet Spraying Compared with Dusting for the Control of Blister Blight on Ceylon Tea 345

LEES, A. B.: The Ferguson Organisation . 419

LEWIS, A. H., D.Sc.: I.C.I. and Jealott's Hill Research Station 247

MACLAGAN GORRIE, R., D.Sc.: Soil Erosion in Ceylon Tea 265

MACLUSKIE, HECTOR, Dip.Agr.: Reclamation of Mangrove Swamp Areas for Rice Cultivation 129

MASEFIELD, G. B., M.A., A.I.C.T.A.: Aspects of British Colonial Agricultural Law
Part I: Irrigation 285
Part II: Inspection and Grading of Products 313
Part III: Crop Controls 357

METCALF, JOHN E.: Decline of Plantation Agriculture in Indonesia 410

MORTEN, I. H.: Southern Rhodesian Tobacco Industry 232

NORRIS, H.: International Harvester Company 315

NYE, G. W., O.B.E., B.Sc.: Some Agricultural Developments in British Colonial Africa 273

OGG, SIR WILLIAM: Modern Developments in Soil Science 181

PIRIE, N. W., M.A., F.R.S.: Protein Production from Green Leaves . . 374

POSNETTE, ADRIAN F., B.A., A.I.C.T.A.: Virus Decline Disease of Citrus . . 64

REID, ROBERT D.: Recent Strawberry Breeding in Scotland 87

RETIEF, D. F.: Tobacco Farming in South Africa 237

RUSSELL, E. W., Ph.D., M.A.: Base Exchange in Soils 145

SIMMONDS, N. W., M.A., A.I.C.T.A., F.L.S.: Bananas and Manila Hemp . 407

SMITH, HARRIS P.: Progress in Mechanised Cotton Production in the U.S.A. . 175

STINSON, F. A.: Tobacco Research in Southern Rhodesia 234

TINCKER, M. A. H., M.A., D.Sc.: The Soilless Cultivation of Plants . . 201

TOMBS, D. M., M.Sc., D.I.C., A.M.I.E.E.: The Application of Electronics to the Cleaning of Agricultural Products . 422

VAN SLUIS, E. J. H.: Artificial Light in Horticulture 161

WOODWARD, F. H., B.Sc., Ph.D., F.R.S.E.: Seaweeds—A New Source of Chemicals and Food 403

WRIGHT, S. J., M.A.:
Some Agricultural Problems of Pakistan 23
The Ford Motor Co. 57

ZIMMER, S. J.: The Mechanics of Spraying 335

Formula for foodstuff fumigation . . .

Methyl Bromide-M&B

Sorption very low and temporary
Easily and speedily dispersed after treatment
Low in cost and economical in application
Stable over long periods
No fire hazard

Supplies: returnable cylinders of 140 lb
We shall be pleased to advise on your particular pest problems.

Highly toxic and extremely penetrative, Methyl Bromide-**M&B** exterminates a wide range of insect pests without leaving harmful residues. For these main reasons, it is being widely and successfully used for the fumigation of stored grain, dried fruits, nuts, and other commodities for human consumption, including tobacco, spices, herbs, and seeds.

A consideration of the further aspects of fumigation will emphasize the other★ advantages of this versatile fumigant.

METHYL BROMIDE M&B

MANUFACTURED BY **MAY & BAKER LTD · DAGENHAM · ENGLAND**

ASSOCIATED HOUSES · BOMBAY · LAGOS · MONTREAL · PORT ELIZABETH · SYDNEY · WELLINGTON · BRANCHES AND AGENTS THROUGHOUT THE WORLD

Index to ADVERTISERS

	Page
Allied National Corp. Ltd.	Nov.
Allman, E., & Co. Ltd.	xliv
American Chemical Paint Co.	xxxiii
Baker, T., & Sons Ltd.	xvi
B.A.M.M.E.X. Assoc.	xvi
Bayer Agriculture Ltd.	xxxviii
Berk, F. W., & Co. Ltd.	xxxvii
B.O.E. & C.C. Ltd.	xxx
Buckner Manufacturing Co. Ltd.	xxix
Burt, Boulton & Haywood Ltd.	viii
Cade Export Co. Inc.	xvi
Caldwell, E. L., & Sons	xxvi
Carter, J. Harrison, Ltd.	xx
Caterpillar Tractor Co.	ix
Chemical & Carbon Prod. Ltd.	xxxiv
Christy & Norris Ltd.	xviii
Clean Crops Ltd.	xxx
Clifford Aero & Auto Ltd.	xxxii
Clyde Navigation Trust	vi
Cooper, Pegler & Co. Ltd.	xxvi
Craven, W. J., & Co. Ltd.	Nov.
Curran, Edward, Engng. Ltd.	Oct.
Darlington, W., & Sons Ltd.	xiv
Dashwood Engineering Ltd.	x
Dorman Sprayer Co. Ltd.	xiv
Drake & Fletcher Ltd.	vi
Engleburt Huller Co. Inc.	Nov.
English Drilling Equip. Co. Ltd.	x
Ferguson, Harry, Ltd.	vii
Four Oaks Spraying Machine Co. Ltd.	xxix
Ford of Dagenham	xxii
French, W. T., & Co. Ltd.	Oct.
Gallenkamp, A., & Co. Ltd.	viii
Grant, Lewis C.	xxviii
Gunson, R. W., (Seeds) Ltd.	xxvii
Halse, John W.	xxxvi
Hardy, M. W., & Co. (Mercantile) Ltd.	xxx
Hercules Powder Co. (Inc.)	xvii
Hudson, H. D., Mfg. Co.	Oct.
Hudson, Kenneth, & Son	xx
Humberside Agricultural Ltd.	Nov.
International Harvester Co. of Great Britain Ltd.	xi
International Seed Inc.	Oct.
Janda Chemical Ltd.	Nov.
Kennedy & Kempe Ltd.	xxxii
King, Geo. W.	Nov.
M. & G. Products Ltd.	xxxiv
Malayan Information Agency	Sept.
Mangers, J., & Sons Ltd.	Oct.
Massey-Harris Ltd.	Oct.
May & Baker Ltd.	iii
Meldrum, D., & Sons	xx
Metal Box Co. Ltd.	xxv
Microsol Ltd.	xii
Mirvale Chemical Co.	xxviii
Mitchell, Colman & Co. Ltd.	Nov.
Monsanto Chemicals Ltd.	Cover ii
Murphy Chemical Co. Ltd.	v
Nu-Way Heating Plant Ltd.	xxxiv
N.V. Noury & Van Der Lande's Exploitatie Maatschappij	Nov.
Oberdorfer Foundries Inc.	Nov.
Olding, Jack, & Co. Ltd.	Nov.
Oliver Corporation, The	xxxi
Page, Charles, & Co. Ltd.	Nov.
Palfrey, William, Ltd.	Sept.
Pan Britannica Industries Ltd.	Cover iii
Pest Control Ltd.	xxi
Piper Aircraft Corporation	xxix
Plant Protection Ltd.	xix
Port of London Authority	Nov.
Pyke, Joseph, & Son (Liverpool) Ltd.	xxxii
Ransomes, Sims & Jeffries Ltd.	xl
Rohm & Haas Co.	xiii
Rotary Hoes Ltd.	Cover i & xviii
Salopian Engineers Ltd.	xxxvi
Scottish Mechanical Light Industries Ltd.	xxxvi
Scott, George, & Son	Nov.
Scottish Aviation Ltd.	xxxix
Shell Petroleum Co.	xxiv
SMALL ADVERTISEMENTS	xli—xliii
Societe Francaise Electro-Chimie	xxx
Spraying Systems Co.	xviii
Steel Fabricators (Cardiff) Ltd.	xxx
Tecalemit Ltd.	xxxv
Thwaites, The, Agricultural Engineering Co. Ltd.	xxviii
Universal Asbestos Overseas Ltd.	Nov.
Universal Crop Protection Ltd.	Cover iv
Velsicol Corporation	xv
Waeco Ltd. (Fumite Division)	xxvi
Waldron, Philip B., Co.	xliii
Walker, T. R., Ltd.	xxiii
Wolseley Sheep Shearing Machine Co. Ltd.	iv

TO ADVERTISERS

Blocks for use in advertisements in WORLD CROPS, which are sent to us from outside the United Kingdom must be labelled:

'For reproduction in an advertisement in a British Trade Journal. For return or destruction after use. No commercial value. Reference BO/31505/32.'

The world food shortage means that livestock breeders everywhere must get the maximum value from their grass. That is why the Wolseley Electric Fencing System has achieved world-wide popularity. It is the ideal method for strip and rotational grazing and for all permanent or temporary enclosures. It is easy to erect and move and costs very little to run.

RECOGNISED AS THE BEST RIGHT ROUND THE WORLD

Wolseley manufacture everything required for erecting and maintaining Electric Fencing under all conditions and for all classes of farm livestock.

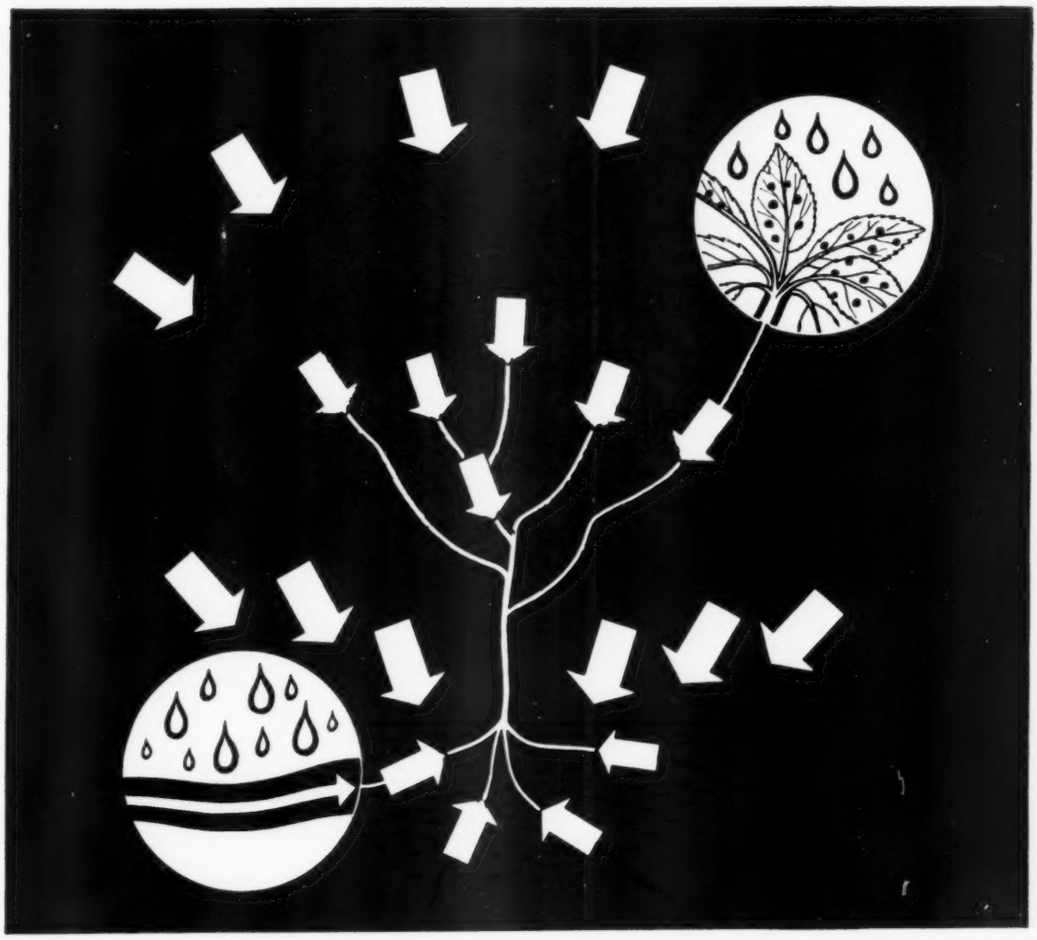
Send for full details.

WOLSELEY

ELECTRIC FENCING

THE WOLSELEY SHEEP SHEARING MACHINE CO. LTD., WITTON, BIRMINGHAM, 6, ENGLAND

SYTAM systemic insecticide



DESTROYS RED SPIDER and APHIS on Hops, Apples, Strawberries and other crops but leaves their natural enemies.

SYTAM is based on SCHRADAN, bisdimethylamino-phosphonous anhydride, and is biologically standardized.

B F P O — bisdimethylamino-fluorophosthine oxide for control of mealybug on Cocoa, Coffee, Vine, Citrus etc.

B F P O is available in experimental quantities.

Write for details to:

THE MURPHY CHEMICAL COMPANY LIMITED

WHEATHAMPSTEAD · HERTFORDSHIRE · **ENGLAND** · *Cables: Alvesco · Wheathampstead · St. Albans*

NEW SPRAYERS
at the Smithfield Show

'MISTEJECTA'

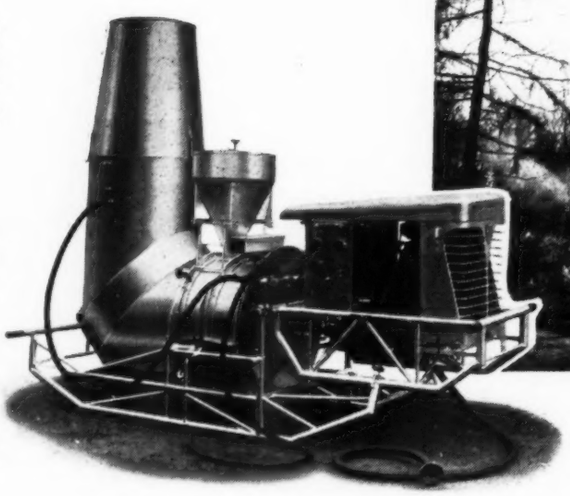
The entirely new machine for spraying powder or liquid fungicides and insecticides up to 100 ft. in height, or over 200 ft. horizontally. Designed for fungoids or pests in Rubber, Tea, etc., and for Locust control. Portable or for mounting.

'DUSTEJECTA' (MINOR)

New design of this famous machine for throwing powders to great heights with total weight of only 144 lbs. Used in Tea and Rubber Plantations. Portable or for mounting on tractors.

'KNAPSACK' ACCESSORIES

Famous lightweight pneumatic Knapsack sprayer can now be supplied with Hand Charge Pump for charging sprayers for battery use in plantations. Also Hand Trolley.



The above illustrations show DUSTEJECTOR MINOR throwing powders to great height, and the new MISTEJECTOR.

DRAKE & FLETCHER LTD MAIDSTONE, KENT PHONE: 2284

Direct Shipments to and from

The PORT *of* GLASGOW

on the River Clyde, serve
at attractive charges

INDUSTRIAL SCOTLAND

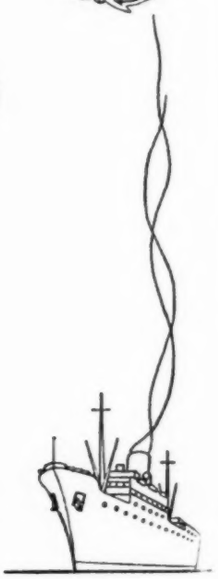
and adjoining territory

Facilities of the First Class
for Ships and Cargoes—
Foreign and Coastwise

Write GENERAL MANAGER

The Clyde Navigation Trust

16 ROBERTSON ST., GLASGOW, C.2



The simplest Farming System ever known!

Only with the exclusive Ferguson System is it possible for anyone—even old or young—to do practically every job on the farm, quicker, cheaper and easier.

The Ferguson System is simple to operate because it was designed with world conditions in view—for all types of ground, for use by unskilled labour of any nationality. Fingertip hydraulic control enables the light, powerful Ferguson tractor to be worked as one unit with a wide range of Ferguson implements. Maintenance is easy, too—one spanner does all field adjustments.

This System produces greater traction and stability without massive built-in weight. It is therefore cheap to buy and run. It works in situations impossible for heavier machinery. It helps grow more food more cheaply than ever before.

Above all, the Ferguson System is easy to understand. That is one of the reasons why it is today making farming faster and better in seventy-six different countries.

Grow more food-more cheaply-with

Ferguson

Mechanical weeding of cereals in India

Ferguson tractors are manufactured for Harry Ferguson Ltd., Coventry, England, by The Standard Motor Company Ltd.

Experience is behind our Products

The Laboratory Equipment and Scientific Apparatus which has made the name Gallenkamp well known is the result of long experience. By using Gallenkamp equipment you are gaining the benefit of this experience in your organisation.

GALLENKAMP SPECIALITIES INCLUDE

CENTRIFUGES — Junior and Universal models

For general purpose use as drying ovens or sterilizers — **OVENS**

FURNACES — For ash determination

Anhydric or water-jacketed — **INCUBATORS**

WATER-BATHS — General purpose and Warburg type

For distillation, extraction, filtration, etc. — **STANDARD JOINT GLASSWARE**

VOLUMETRIC GLASSWARE — *'Technico'* N.P.L. Class A, *'Technico'* Grade A and *'Technico'* Grade B

Gallenkamp REGD.

A. GALLENKAMP & CO. LTD.
17-29 SUN STREET, LONDON, E.C.2.
ENGLAND.

Ialine REGD.

SELECTIVE WEED KILLERS

OF

- **HIGH AVERAGE OF CHEMICAL QUALITY**
- **PROVED BIOLOGICAL PERFORMANCE**
- **COMPETITIVE PRICE**

2,4-D AMINE SALT containing 50% w/v 2,4-Dichlorphenoxyacetic acid.

2,4-D ACID a white powder of minimum 98% purity for formulation.

2,4-D SODIUM SALT a fine flowable powder containing a minimum of 80% 2,4-D Acid.

MCPA SPRAY a standard product containing 30% MCPA.

DNOC SELECTIVE WEED KILLER a paste with good suspension properties containing 3 lb. of activated Dinitro-ortho-Cresol per gallon.

BRUSHWOOD KILLER a combination of low volatile esters of 2,4-D and 2,4,5-T containing 50% w/v 2,4-D Acid and 25% w/v 2,4,5-T Acid.

2,4-D ESTER FLUID a low volatile ester containing 50% w/v 2,4-D Acid.

2,4,5-T ESTER FLUID a low volatile ester containing 50% w/v 2,4,5-T Acid.

Ialine REGD.

BURT, BOULTON & HAYWOOD LTD
CRABTREE MANORWAY
BELVEDERE · KENT
Tel: Erith 3066

Tread marks leading to a better life

Soon the sluggish waters of Pakistan's Indus River will wash away these traces of the big yellow machines which worked here. But behind them they will leave something more permanent. Fertile fields, thriving crops, more food.

For when the task of the earthmovers is finished, thousands of acres of the Sind Desert will provide food for hungry stomachs.

Sind Province Public Works Department is building a large low-level dam to raise the waters of the Indus into right and left bank irrigation canals. "Caterpillar" Diesel Tractors and Scrapers are excavating the main channel through which the irrigation water will flow. "Caterpillar" Motor Graders are finishing the fill and sloping canal banks. "Caterpillar" Diesel Electric Sets are providing power for floodlighting so the important work can continue around the clock.

The dam and channels they are creating are a permanent contribution to the economy of Pakistan.

CATERPILLAR TRACTOR CO., PEORIA, ILL., U. S. A.

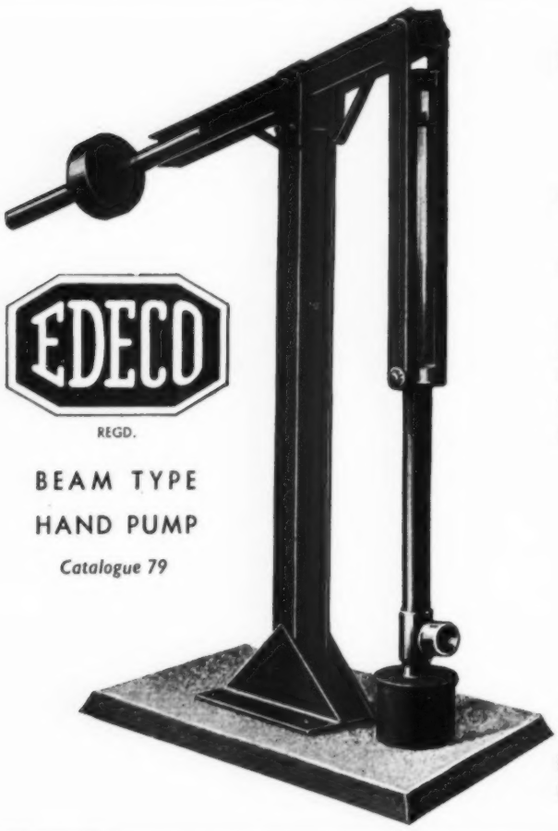
Licensees in England, France, Australia and South Africa manufacture earthmoving equipment to "Caterpillar" specifications under the following trade marks:

BIRTLEY • CORPET LOUVET • STEELWELD • WRIGHT

CATERPILLAR

REGISTERED TRADE MARK

DIESEL ENGINES
TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT



EDECO

REGD.

BEAM TYPE
HAND PUMP

Catalogue 79

ENGLISH DRILLING EQUIPMENT CO. LTD.

BILBAO HOUSE · NEW BROAD STREET
LONDON EC2

Phone: London Wall 4941-4 **Grams: Bullwheel, Ave., London**

This pump is eminently suitable for use in bore holes yielding comparatively small quantities of water for domestic or animal consumption where the rest water level is below suction depth.

The following figures are given as an approximate guide to the yields that may be expected:

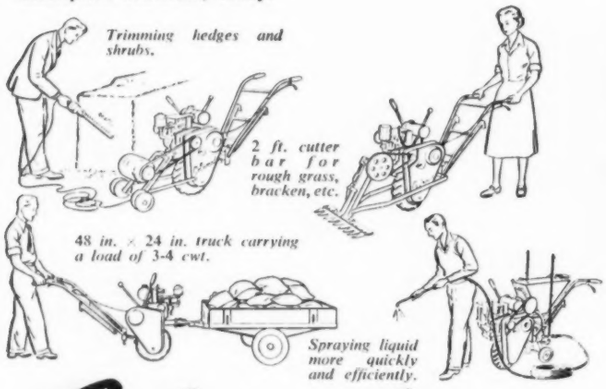
DEPTH (HEAD)	PUMP DIAMETER	FIXED STROKE	APPROX. STROKES/MIN.	GALLONS PER MIN.
150′	1¾″	8″	40	2.7
100′	2¼″	8″	40	4.5
75′	2¾″	8″	40	6.2
50′	3¼″	8″	40	9.5

SUBSIDIARY COMPANIES

EDECO PROSPECTORS LTD. **EDECO (TRINIDAD) LTD.**
EDECO CANADA LTD. **EDECO GERMANY G.m.b.H.**

The finest single wheel tractor for every cultivating job

The Colwood Garden Tractor enables you to do so many jobs more quickly and efficiently. Designed primarily as a Hoe and Cultivator, a standard power take-off enables you to fit additional equipment for grass-cutting and mowing, spraying, dusting, seed sowing and broadcasting, fertilizer spreading, hedge trimming and pumping. It is economical and requires little maintenance. Write for descriptive brochure, today.


Trimming hedges and shrubs.
2 ft. cutter bar for rough grass, bracken, etc.
48 in. × 24 in. truck carrying a load of 3-4 cwt.
Spraying liquid more quickly and efficiently.

Stand No. 30
Smithfield Show
Dec. 8 - 12

Taking the push out of hoeing, with the Colwood.

Colwood GARDEN TRACTOR

DASHWOOD ENGINEERING LTD., EMPIRE WORKS, LONDON, S.E.20. **'Phone: SYDenham 5161**

Get the right tractor for the job!

It's made by IH

Ploughing three or four furrows where only two could be ploughed before . . . halving harrowing time by trailing implements in tandem . . . cutting a wider swath in the hayfield . . . saving journeys to and from the field by hauling bigger loads . . . That's how the Farmall BM gets to grips with the job — effects *real* economy. It's the truly all-purpose tractor that can tackle the lighter duties as efficiently and speedily as a small tractor, yet delivers the unflagging extra power you want for the big seasonal operations. No tractor is more easily handled. No tractor converts fuel into energy more economically. And no tractor gives so many years of service in return for so little attention.

McCORMICK INTERNATIONAL

FARMALL BM TRACTOR

FARMALL BM FACTS

4 cylinder O.H.V. engine

Drawbar h.p. 32.86
Belt h.p. 36.70

Five forward speeds and reverse

Variable wheel treads
FRONT 57″ – 81″
REAR 52″ – 88″

Clearance
UNDER REAR AXLE 25½″
UNDER REAR FRAME 17¾″

INTERNATIONAL HARVESTER

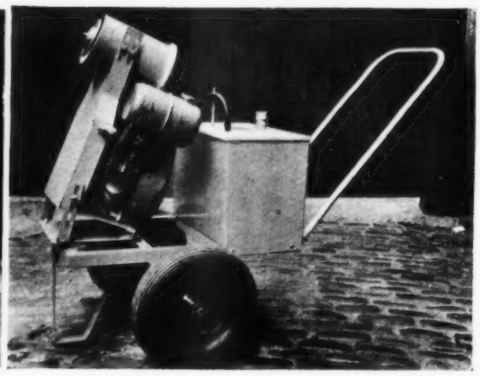
If it's an IH machine it's a real investment

INTERNATIONAL HARVESTER

COMPANY OF GT. BRITAIN LTD HARVESTER HOUSE 259 CITY ROAD LONDON EC1

1 BILLION INSECTICIDAL BULLETS PER SECOND *for*

MODEL 202



MODEL 304

Microsol is the mechanical fog generator with a variable particle size output of between 5 and 125 microns, *AT A PRICE WITHIN REASON, FOR BOTH LARGE AND SMALL USERS.*

In contrast with its high output and efficiency, Microsol is light and compact, its construction robust and its serviceability of a high order. It can be operated by unskilled labour. *THERE ARE THOUSANDS IN DAILY USE.*

There are four models. The Model 202 electrically driven, output up to 3¼ gallons per hour (4 U.S. gallons); the Model 303 electrically driven, output up to 33 gallons per hour (40 U.S. gallons); the Model 304 petrol engine driven, output up to 33 gallons per hour (40 U.S. gallons); and the Model 403 petrol engine driven, output up to 165 gallons per hour (210 U.S. gallons). Both electrical models are AC/DC.

Used successfully in a wide variety of applications in many parts of the world, Microsol equipment is now available from both dollar and sterling sources. SEND FOR FULL INFORMATION TO EITHER OF THE UNDERMENTIONED ADDRESSES.

COTTON
TEA
RUBBER
WAREHOUSES
SHIPS
MOSQUITO AND LOCUST CONTROL
PUBLIC HEALTH
HOSPITALS
ODOUR CONTROL
THEATRES
HOTELS
CLUBS
VITICULTURE
HORTICULTURE
AGRICULTURE
FOOD MANUFACTURE AND PROCESSING
MILLING
DAIRIES
CATTLE FOGGING

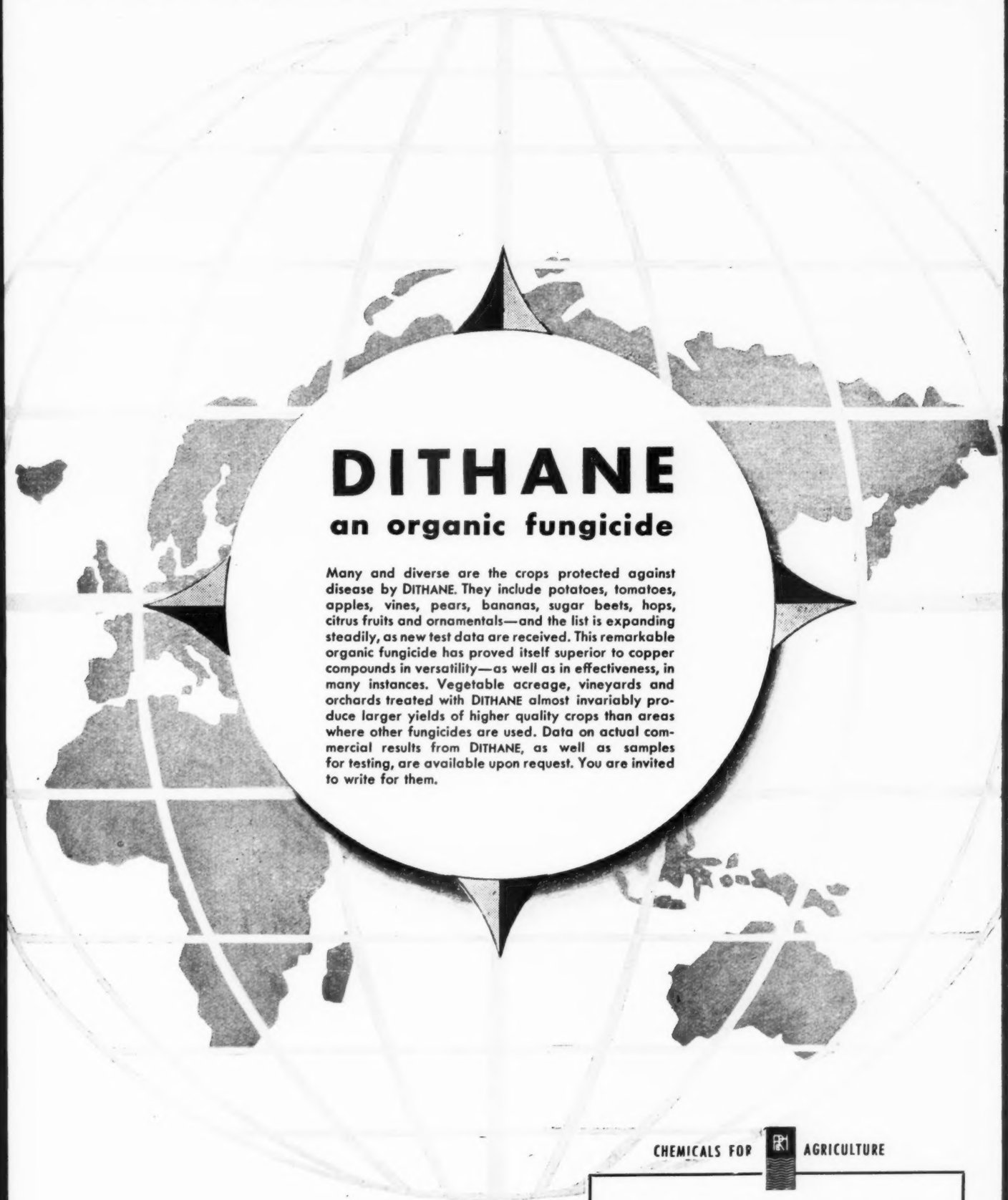
MICROSOL

Mechanical Fog Generator

MICROSOL INDUSTRIES, LTD.,
CARLISLE HOUSE,
8, SOUTHAMPTON ROW, LONDON, W.C.1
Telephone : Chancery 8172/9
Cables : Microsol, London

SILVER CREEK PRECISION CORP.,
50 BROADWAY, NEW YORK CITY, U.S.A.
Telephone : Digby 4-0137
Cables : Silvacreek, New York

now replacing copper compounds in many areas...



DITHANE
an organic fungicide

Many and diverse are the crops protected against disease by DITHANE. They include potatoes, tomatoes, apples, vines, pears, bananas, sugar beets, hops, citrus fruits and ornamentals—and the list is expanding steadily, as new test data are received. This remarkable organic fungicide has proved itself superior to copper compounds in versatility—as well as in effectiveness, in many instances. Vegetable acreage, vineyards and orchards treated with DITHANE almost invariably produce larger yields of higher quality crops than areas where other fungicides are used. Data on actual commercial results from DITHANE, as well as samples for testing, are available upon request. You are invited to write for them.

CHEMICALS FOR AGRICULTURE

Societe MINOC S.A.R.L.,
3 AVENUE DU PRESIDENT WILSON,
PARIS 16, FRANCE

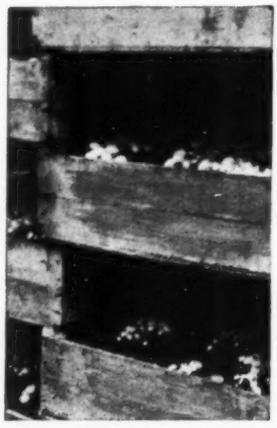
DITHANE is a trade mark Reg. U.S. Pat. Off.

For Finest Crops . . . . . .

from Shelves, from Trays, from Beds

Whether you favour the shelf, tray or flat-bed system of Mushroom Culture, you will find that the heaviest crops result from the use of 100% spawn. And, because of our exclusive technique employed for spore selection and propagation, crops are consistently of the highest possible quality — outstanding in flavour, size and colour.

It pays to use Darlington's 100% Spawn.



Our Advisory Department will be pleased to give information or guidance on Mushroom Growing to any Commercial Grower.

DARLINGTON'S
100%
PURE CULTURE
MUSHROOM SPAWN

W. DARLINGTON & SONS, LTD., WORTHING, SUSSEX, ENGLAND

THE DORMAN 20 GALLON SPRAYER. This surprisingly low priced sprayer is ideally suited for the farmer with a limited acreage to spray. Features include a 20 gallon tank, 15ft. sprayboom designed for height adjustment, and positive anti-drip device. A simple "one-man" job to fit a range of tractors.

See these new developments AT THE SMITHFIELD SHOW
STAND No. 189

The rapid strides made during the past few years in the development and design of agricultural crop spraying machinery is clearly reflected throughout the wide and complete DORMAN range—leaders in this field of the agricultural machinery industry.

We extend a hearty welcome to our stand at Earls Court to inspect a few models from our range which will be of real interest to farmers and spraying contractors.

DORMAN "WHEELBARROW" SPRAYER. This excellent 15 gallon sprayer is complete with independent engine driven pump and may be used with a variety of front mounted low and high volume spraybooms, or is easily adaptable for fitting handlances and hose for bush and cattle spraying.

DORMAN 75 GALLON TRAILER SPRAYER. This light weight low medium volume sprayer is designed for applications from 5 to 50 gallons per acre. Complete with 21' 6" "shock-absorber" spray-booms, row crop axle, positive anti-drip device and large capacity gear pump directly coupled to P.T.O.

DORMAN SPRAYER CO. LTD. 408, Cherry Hinton Rd., CAMBRIDGE
Telephone: Cambridge 87385

For Effective Control of Insect Pests in Home, Garden and Field

Six years of world-wide applications have proved chlordane to be highly effective in the control of insect pests. In addition, it also controls a wider range of insects which damage or destroy crops. Every day brings new reports from growers and researchers, world-wide, as to the advantages of chlordane.

It will pay you, too, to get the free facts about chlordane effectiveness and ease of application in wettable powders, dusts, water-emulsions and in fertilizer-admixtures. Please write for bulletins

EFFECTIVE IN CONTROL OF

Armyworms
Blister Beetles
Boxelder Bugs
Brown Dog Ticks
Cabbage Maggots
Cattle Lice
Chiggers
Chinch Bugs
Cutworms
Cotton Boll Weevils
Darkling Beetles
Earwigs
Grasshoppers
Japanese Beetle Larvae
Lawn Moths
Lygus Bugs
Mole Crickets
Mormon Crickets
Onion Maggots
Onion Thrips
Plum Curculio
Sarcoptic Mange
Seed-Corn Maggots
Serpentine Leaf Miners
Sheep Ked
Sod Webworms
Southern Corn Rootworms
Strawberry Crown Borers
Strawberry Weevils
Sweet Clover Weevils
Tarnished Plant Bugs
Ticks
White Grubs
Wireworms

HOUSEHOLD PESTS

Ants
Cockroaches
Crickets
Fleas
Flies
Household Spiders
Mosquitoes
Silverfish
Termites

. . . AND MANY OTHERS

PETROLEUM DERIVED CHEMICALS
VELSICOL
SERVING BASIC INDUSTRIES

VELSICOL CORPORATION

General Offices and Laboratories
330 East Grand Avenue, Chicago 11, Illinois

Foreign Division
100 East 42nd Street, New York 17, New York

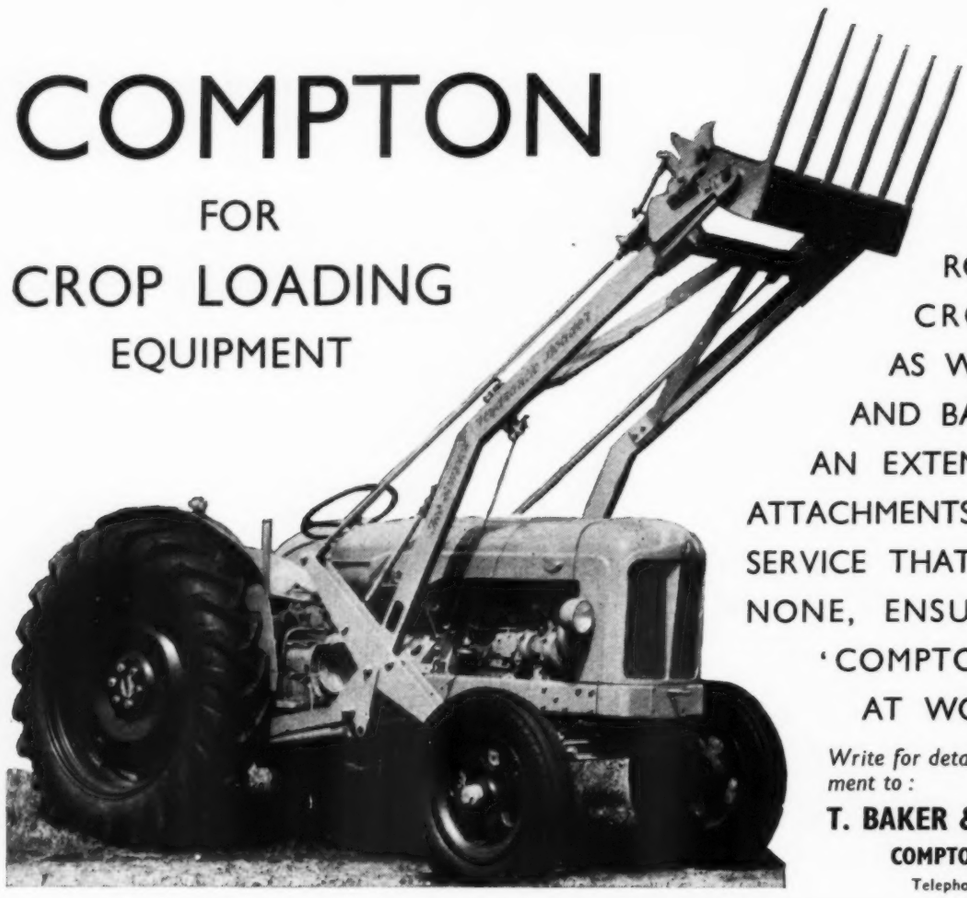
REPRESENTATIVES IN PRINCIPAL COUNTRIES

COMPTON

FOR

CROP LOADING

EQUIPMENT



HERE IS THE COMPLETE TOOL FOR ALL ROOT AND GREEN CROP HANDLING AS WELL AS MANURE AND BALLAST LOADING. AN EXTENSIVE RANGE OF ATTACHMENTS, PLUS A SPARES SERVICE THAT IS SECOND TO NONE, ENSURES THAT THE 'COMPTON' IS ALWAYS AT WORK

Write for details of this and other equipment to :

T. BAKER & SONS (F. & E.) LTD

COMPTON, BERKS, ENGLAND

Telephone : Compton 66, 67, 73

BAMMEX

An Association of British Agricultural Machinery and Implement makers engaged in export trading.

B.A.M.M.E.X. provides an experienced staff capable of advising from both the agricultural and technical angle, with a broad knowledge of both European and Tropical agriculture, which is available both to the manufacturer and to the buyer from overseas.

The closest liaison is maintained with all Government departments, and B.A.M.M.E.X. can be looked on as being officially recognized as the trades' most effective export organization.

It has the closest relations both with foreign Embassies and Dominion and Colonial Offices. B.A.M.M.E.X. can investigate members' problems, and wherever possible will find a solution.

The latest information, technical specifications and manufacturers' literature can be obtained at Dashwood House.

Personal Interviews can always be arranged.

THE BRITISH AGRICULTURAL MACHINERY MANUFACTURERS' EXPORT ASSOCIATION

222-227 Dashwood House, 69 Old Broad Street

London, E.C.2, England

Telephone : LONdon Wall 6922 (3 lines) Cables : Bammex, London

---

THE MOST IMPORTANT PART OF YOUR CROP IS THE

SEED

Improve your yields by planting imported pure seed. Produced by world's best plant breeders.

Our Specialties

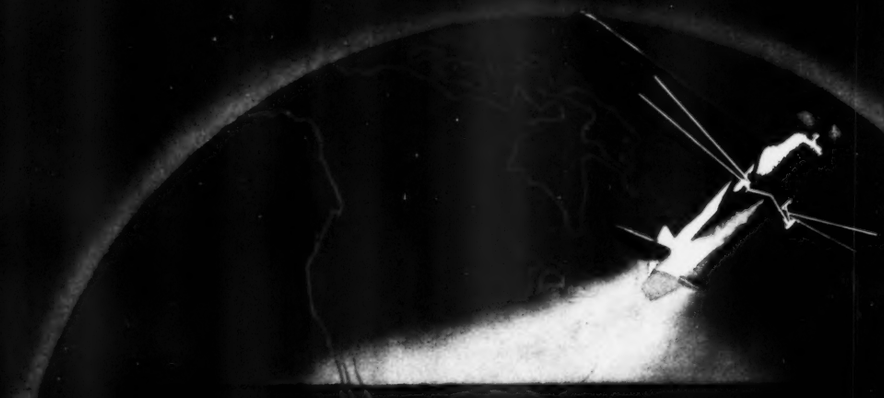
COTTON — RICE

CADE EXPORT CO., INC.

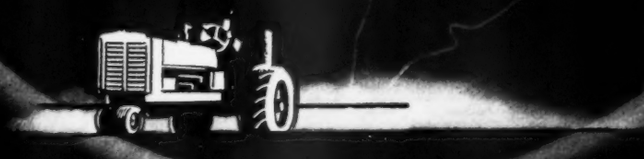
P.O. Box 1946-U Cable Address : CADECO

ALEXANDRIA, LOUISIANA, U.S.A.

TOXAPHENE



AGRICULTURAL



INSECTICIDES

HERCULES POWDER COMPANY

WHATEVER YOUR TRACTOR

Now you can reap the benefits of ROTAVATION!

Direct-power cultivation with the Rotavator provides today's finest means of quickly perfecting seed-beds, turning-in vegetation and manures, and working combine straw and stubble back into the land. And now it's a matter of moments to couple up this new type Rotavator to the standard draw-bar and p.t.o. of any light-medium or medium tractor, and drive away, to cultivate thoroughly on many soils, at 2½ acres per hour!

THE HOWARD
TRAILING ROTAVATOR

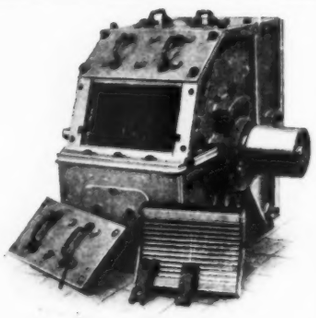
ROTARY HOES LIMITED
STATION RD., HORNDON, ESSEX, ENGLAND

Prices (Ex Works) from £245
Cables: ROTCVATE, BRENTWOOD

Disintegrating and Pulverising Specialists

The Swing Beater Pulveriser illustrated, is of sturdy construction for heavy work and suitable for grinding **fertilisers, limestone, gypsum, bone, hoof** and **horns.**

This thoroughly proved mill—with a world-wide reputation—is supplied in five sizes, 18 B8 (10-20 H.P.) to size 24 B24 (45-90 H.P.), the effective use of which Christy & Norris engineers will be glad to discuss with you.



Christy and Norris Ltd

STAND No. 20—SMITHFIELD SHOW
Chelmsford • England

TIPS THAT SOLVE YOUR SPRAYING PROBLEMS

SPRAY NOZZLES
WITH INTERCHANGEABLE ORIFICE TIPS

Here are the spray nozzles that have helped create a miracle in farming . . . by controlling weeds and insect pests to a degree never before thought possible. Tee-Jet Spray Nozzles were the first of their type ever built, are now standard throughout the world . . . for spraying such crops as corn, wheat, cotton, rice, vegetables and fruits.

Write for Bulletin 58 . . . a complete reference catalog on TeeJet Farm Spray Nozzles, strainers and fittings.

SPRAYING SYSTEMS TeeJet SPRAY NOZZLES

OUTSELLS ALL OTHERS BECAUSE OF FEATURES LIKE THESE

- Drilled and Milled orifice tips for super-precision . . . for exact volume control, uniform distribution, and long wear.
- Factory inspection and testing of all nozzles and tips before shipment.
- Interchangeable orifice tips . . . every spray type in complete capacity range from one gallon per hour and up.
- Eleven different spray angles from 0° to 150° in all capacities.

SPRAYING SYSTEMS CO. 3281 Randolph Street Bellwood, Illinois, USA

The science of plant protection

Your crops deserve full protection . . .

Valuable crops — crops such as bananas, tea, hops, vines, potatoes and tomatoes — need complete protection if they are to realise their full value. Against fungus diseases, 'Perenox' provides that protection. 'Perenox' is a spray containing a particularly active form of cuprous oxide, together with a suitable dispensing agent. It saves labour, is economical to use and reduces freight charges — for it comes in easily handled drums, concentrated, needing nothing but added water to be ready for use.

. . . keep fungus disease away with 'Perenox'

COPPER FUNGICIDE

For further information, or if you have any plant protection problems on which you require advice, please write to: Room 61, Plant Protection Ltd, 61 Curzon Street, London, W1, England

Plant Protection Ltd

GREATER PENETRATION WITHOUT CLOGGING

The Hudson Disc Plough's great strength, weight, wide clearance, 26" diameter discs and ease of control, make it the ideal plough for use on a difficult terrain. Our illustration shows one being drawn by a Nuffield Tractor in Southern Rhodesia.

Approved by Nuffield Organisation and Turner Manufacturing Co., and suitable for New and Old Fordson Major, Marshall and David Brown.

KENNETH HUDSON & SON · DARLASTON · STAFFS

AFFORESTATION

"Since it is certain and demonstrable that all arts and artisans whatsoever must fail and cease if there were no wood in a nation (for he that shall take his pen and begin to set down what art, mystery, or trade belonging any way to human life could be maintained and exercised without wood will quickly find that I speak no paradox). I say when this shall be well considered, it will appear that we had better be without gold than without timber."— Extract from Evelyn's "Sylva."

The above, though written over 280 years ago, applies more today.

Replant those felled areas NOW

Let us quote prices for

Forest Tree Seed, Seedling and Transplants, in the leading varieties, also ornamental Trees, Fruit Trees and Shrubs

Tree Catalogue on request Seed Catalogue issued in February
Correspondence invited

D. MELDRUM & SONS

THE FOREST TREE NURSERIES, FORFAR, SCOTLAND

TELEPHONE: 565 FORFAR TELEGRAMS: 565 FORFAR

When its a CRUSHING & GRINDING PROBLEM Consult

We've solved many problems in our time and it might well be that some problem quite similar to yours, has already been examined in our laboratory or in actual field use. Our research and development organisation is always at industry's service, ready at any time to tackle your job.

J. HARRISON CARTER

offer a wide range of

CRUSHERS

GRINDERS

MIXERS

DISINTEGRATORS

EDGE RUNNER MILLS

Machinery for manufacturers of:

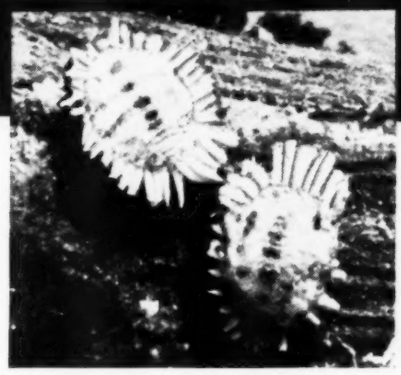
Agricultural Chemicals, Bone Meal Bone Flour, Milling, Animal Feed

J. Harrison Carter Ltd

DUNSTABLE · BEDS · ENGLAND

TELEPHONE: DUNSTABLE 1191/2

The SYSTEMIC STORY



Adult Pseudococcus njalensis magnified 5 times.

Development of a range of insecticides which are absorbed into the plant's sap stream is being progressed by Pest Control Ltd. who pioneered, with PESTOX 3, the first of these revolutionary chemicals which protect the plant *from within.* Another kindred insecticide, HANANE, is now in commercial production; although it is particularly intended for the control of Mealy Bugs on trees, e.g. Cocoa, Coffee or Citrus, it also controls Aphis, White Fly, Scale Insects and Thrips.

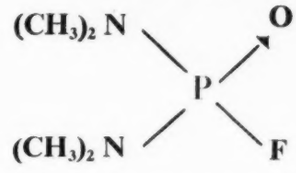
HANANE is an insecticide with marked systemic action and contains 50% w/v of bis dimethylamino fluorophosphine oxide together with other added non-active materials.

Owing to its toxicity HANANE is not recommended as a spray, but as a capsule to be inserted in the soil near to the base of the tree or bush. This capsule method of soil implantation is not only the safest way for the operator, but it also prevents loss of the insecticide which is volatile. The capsules are available in three sizes — 2, 4, and 6 grammes respectively. Packed in this form HANANE is not dangerous to handle.

Dosage depends on species, size of the plant and the period over which protection is required, also air temperature, soil moisture and soil fertility. For these reasons it is advisable to consult the Technical Department, Pest Control Ltd., Cambridge, about the use of HANANE.

While the bulk of the HANANE being manufactured at present is devoted to urgent experiments in the Gold Coast, supplies for other urgent developments and for field-scale experiments may be made available after consultation with our Technical Department.

HANANE

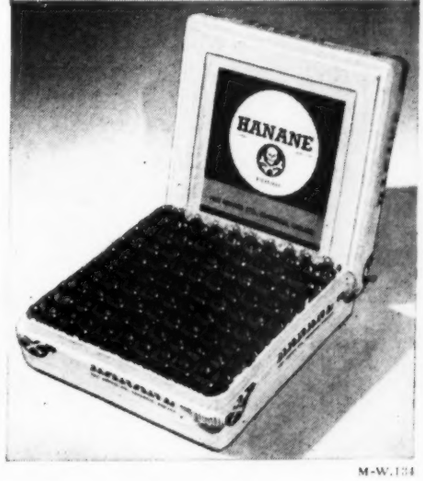


Mol.Wt. 154. Colourless mobile liquid with a faint odour; poisonous vapour; miscible with water and most organic liquids.

Measuring girth width for adjusting dosage.

Applying the Hanane Capsule in the soil.

By Appointment Agricultural Spraying Contractors to the late King George VI



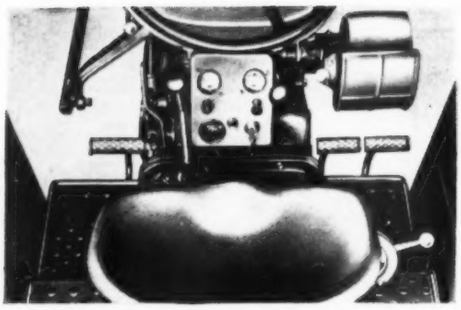
M-W.134

PEST CONTROL LTD. OF CAMBRIDGE

Phone : HARSTON 312

Pest Control Ltd. lead the world in the fight for higher yields. They design, manufacture and supply high-efficiency chemicals and spraying machines for dealing with crop pests. Their Advisory Staff are always ready to help you with your own particular problem.

SMOOTH HANDLING ON ROUGH GROUND



D DIESEL
P PETROL
V VAPORISING OIL

Thanks to 'CAR·TYPE' *Controls*

IT handles so easily! That's one of the first things you notice about the New Fordson Major. Along the steep hillside, through the rough tangle, round that awkward corner, you can steer with scarcely an effort — thanks to 'feather-light' steering. All the controls are grouped near you. Clutch and brake pedals are on normal sides and have non-slip foot grips. You've 6 forward speeds and 2 reverse, powerful hydraulics, extra stability and a host of other advantages. And — you choose your own engine — diesel, petrol or kerosene! All 'New Major' engines have the same cylinder block and a number of common components. That's new in tractor design. It cuts initial prices and saves you money on spares. From first to last, the New Fordson Major is a MONEY SAVER. Ask your Dealer for illustrated leaflet giving you full details.

THE NEW

FORDSON MAJOR

A FORD PRODUCT

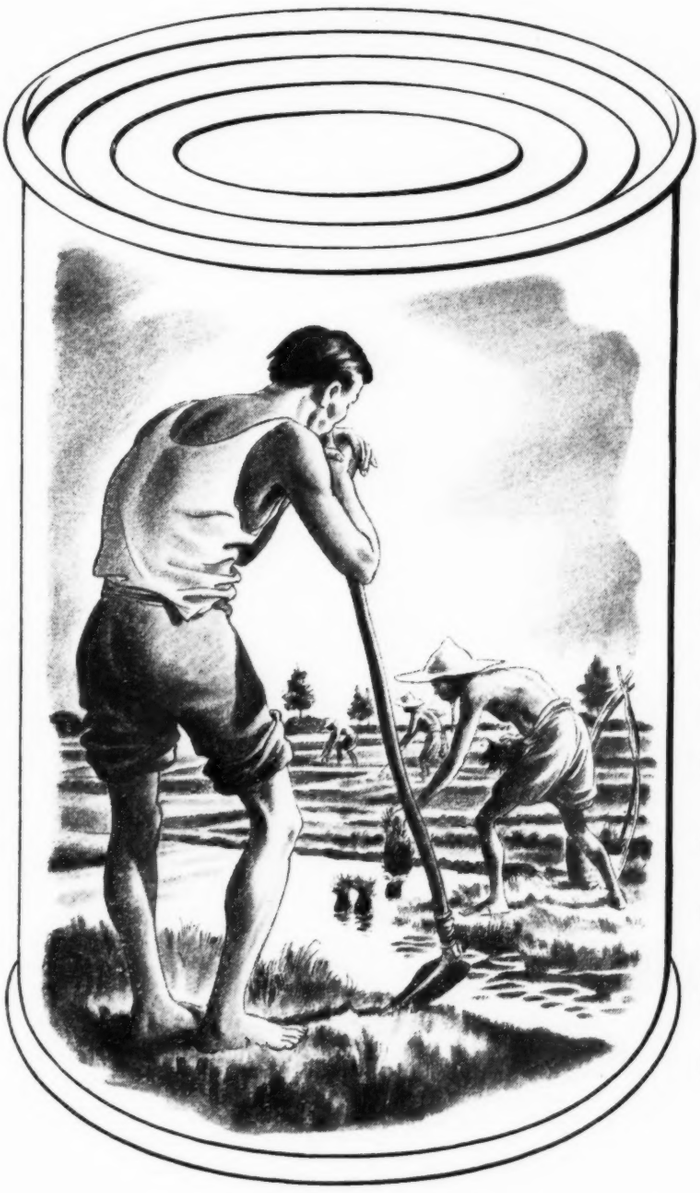
MADE IN ENGLAND

MAJOR FARMING LEADS IN VALUE

"To-day, the forces of nature have been harnessed for mass production.
For the first time ever, a society is possible in which poverty can be abolished, and with it, misery and hunger. The eradication of Hunger is no Utopian scheme; it is a perfectly available objective."

"*Geography of Hunger*", by Josue de Castro,
Late Chairman of the Executive
of the United Nations Food
and Agricultural Organisation.

Promise of the Better Life



BY THE SUPPLY OF CANS in huge numbers for the preservation of food, The Metal Box Company are making a contribution to the "*Eradication of Hunger*". For the canning industry in Great Britain, the Commonwealth and Empire absorbs much of the surplus crops raised by improved methods of cultivation, and thus supplies the peasant cultivators with a market in times of glut, and out-of-season food for the industrial worker in the cities.

THE METAL BOX COMPANY LIMITED, THE LANGHAM, PORTLAND PLACE, LONDON, W.C.1.

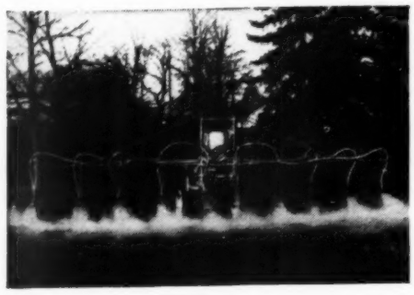
A distinguished name in British Packaging

SPRAYING

For Large or Small Growers there is the right machine for the job, whether applying Washes, Dusts, Weedkillers, Creosote, Disinfectant or Limewash

The 'PULVOVER' High Powered Duster for Rubber, Citrus, Cotton and ALL CROPS. Available with flexible metallic hose high output lance or with 4 or 10 row (as illustrated) adjustable lances, for the treatment of Ground Crops, Cereals, etc.

Container capacity 150 lbs of powder. Distributor which controls output from 35 to 630 lbs per hour.



The 'PULVOVER' High Powered Duster

The following are made and stocked for IMMEDIATE DELIVERY:

● Hand Sprayers ● High Pressure Hand Power Machines ● Powder Sprayers, Hand or Engine Driven Knapsack and Pneumatic Knapsack Models ● Power Sprayers with Auxiliary Engines or Power take-off ● Dust Guns, etc.

● Tank Capacities from 3½ pints to 350 gallons ● Outputs from 3 to 450 gallons per hour ● Pressures from 25 to 570 lbs per square inch

Catalogue from

COOPER, PEGLER & CO. LTD.

SPRAYER MANUFACTURERS, LONDON ROAD, BURGESS HILL, SUSSEX

Known Over the World—

Caldwell's Giant Brush Cutters are recognised as standard throughout the world. Their purpose is two-fold: To clear brush from productive land, and to control the recurring growth. There are six models in the GIANT line, ranging in weight from 3,000 to 21,000 lbs. The machine above is an A-6, equipped with eight 6-foot blades and weighing 6,400 lbs. The Caldwell Giant is not only first choice in the U.S.A. — it is known and used throughout the world. For the complete story of brush control, write for a copy of 'Richer Land and Better Grass'.

E. L. CALDWELL & SONS

CORPUS CHRISTI · TEXAS · U.S.A.

CALDWELL *Giant* BRUSH CUTTER

cable: "BRUSHCUT"

---

new!

FUMITE

DDT/LINDANE REGD.

STORED CROPS kept *PEST-FREE* without tainting

LINDANE is the pure, odourless gamma isomer of Benzene Hexachloride (BHC).

NEW Fumite **DDT/Lindane** Generators ensure lasting freedom from insect pests of all types in every kind of building, vehicle, aircraft, rolling stock and ship's hold. Bagged foods, fruits, etc., can be treated *in situ* without risk of tainting. It's simple, safe **and deadly efficient!**

USE FUMITE AT HOME

A size 1 pellet in a large room gives immediate relief from Flies, Mosquitoes, Wasps, etc., for 2 to 3 days—is quick, safe and simple.

THE SMOKE INSECTICIDE

British patent Nos. 621732, 621894 and 651684—other patents pending

Agents in most countries of the world

Trade enquiries to the Sole Manufacturers:—

WAECO LTD *(Fumite Division)*

120/2 Victoria St., London, SW1 *Phone:* Tate Gallery 9626

Factory: High Post, Salisbury, Wilts.

UPGRADE YOUR PRODUCTS

and secure highest prices in consuming countries.
Good quality will always sell the goods even in
periods of bad trade

**THE NECESSITY OF HAND PICKING
IS ELIMINATED BY THE USE OF**

GUNSON'S SORTEX

PATENTED AUTOMATIC ELECTRONIC SEPARATOR

—LATEST MODEL, TYPE G.2—EACH UNIT ENTIRELY SELF-CONTAINED

REJECTS 3½%

GOOD 96½%

The original bulk contained 3½% of faulty beans which were eliminated at an output speed of 160 lbs per hour. Coffee beans, peas, nuts, seed maize and articles of similar size can be separated with equal results

For particulars write to :

R. W. GUNSON (SEEDS) LTD.

Wholesale Seedsmen

20/21 ST. DUNSTAN'S HILL · LONDON EC3 · ENGLAND

PATENTEES AND SOLE MAKERS

Mirvale

2:4-D SELECTIVE WEEDKILLERS

available for prompt delivery

ACID		98-99% *Active Material*	*White, free-running crystals : Suitable for formulating all 2 : 4-D Weedkillers.*
AMINES	*Triethanolamine* *Diethanolamine* *Methyldiethanolamine*	*Up to 6 lb. 2 : 4-D/gln.* *Up to 7 lb. 2 : 4-D/gln.* *Up to 7 lb. 2 : 4-D/gln.*	*Amber coloured, free-flowing Solutions : Completely Miscible with Water : Ready for immediate use.*
ESTERS	*Ethyl* *Isopropyl* *Butyl (low volatility)*	*11.7 lb. 2 : 4-D/gln.* *10.6 lb. 2 : 4-D/gln.* *9.9 lb. 2 : 4-D/gln.*	*Clear, free-flowing liquids : Soluble in paraffin oil, etc. : Suitable for application as oil-in-water emulsions.*

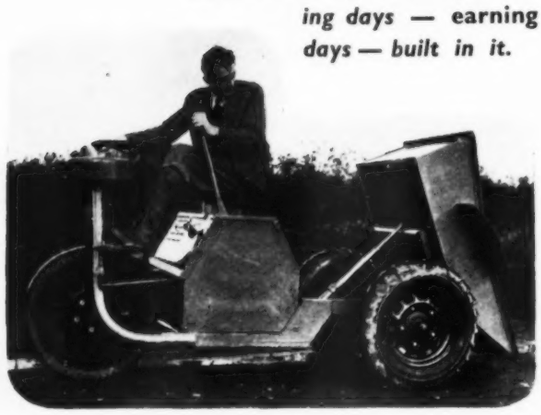
Export enquiries to
JOS. WEIL & SON
FRIARS HOUSE
39-41 New Broad Street
London, E.C.2

Amine Solutions can be supplied in any concentration, to suit customer's particular requirements.

MIRVALE CHEMICAL CO. LTD., Mirfield, Yorks, England

Unrivalled!

No other DUMPER stands so much work—has so many working days — earning days — built in it.



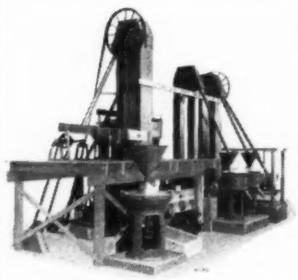
THE THWAITES DUMPER is the result of prolonged and exhaustive trials under the worst possible conditions. The design incorporates certain novel features including CONTROLLED HYDRAULIC TIPPING—NO GEAR BOX.

Capacity: 10 cu. ft. flush. 8 cu. ft. wet concrete = 10 cwt. load. **Price £325**

The **THWAITES** **AGRICULTURAL ENGINEERING CO. LTD.**

Phone & Grams: Leamington Spa 1698

WELSH RD. WORKS - CUBBINGTON - LEAMINGTON SPA



RICE MILLS

This picture shows a Detached type Rice Mill, comprising Paddy Sheller, Separator, Whitening Cones, etc. Fully automatic. Made in several sizes.

LEWIS C. GRANT

DUNNIKIER FOUNDRY · DYSART · SCOTLAND

Manufacturing Chemist

Covers the manufacture of

Proprietary Medicines and Foods, Cosmetics, Soaps, Essential Oils, Toilet Preparations, Dentifrices, Disinfectant, Insecticides, Detergents, Polishes, Veterinary Products, etc.

Annual Subscription 30/- post free

•

Specimen copy on request to:

STRATFORD HOUSE

9 EDEN STREET, LONDON, N.W.1

The Plane That Doesn't Need an Airport!

PIPER SUPER CUB

Call it a sky jeep, call it a flying truck, call it the most useful piece of equipment you could add. In any case, you have the right description for the Piper Super Cub that takes off or lands in less than 50 yards on rough, unprepared ground.

Here's a plane that multiplies the work supervisory personnel can do or which can deliver a quarter-ton of freight right to where you want it.

Imagine how useful the Piper Super Cub could be for you—doing many jobs so much more quickly than by auto or truck even for short trips. Few planes are so safe and easy to fly—none so inexpensive.

For agricultural use the Piper Super Cub is ideal for

- Checking fences
- Dusting and spraying
- By-passing muddy or snow-bound roads
- Servicing windmills
- Locating strays
- Directing round-up by loudspeaker
- Dropping salt
- Rushing medical aid

PIPER AIRCRAFT CORPORATION
LOCK HAVEN, PA., U.S.A.

Write today for full information and literature on all Piper planes. Address your inquiries to Export Dept. A.

ALSO THE FOUR-PASSENGER PIPER PACER AND TRI-PACER

Piper also makes the largest selling four-passenger airplane—available in two models—the Pacer with standard landing gear for maximum performance and the Tri-Pacer with tricycle gear for flying ease. Better than 125 mph cruising speed with over 575 mile range provides remarkable cross-country transportation *with extraordinary economy*. Quiet, comfortable cabin has easily removable rear seat for cargo hauling.

Tri-Pacer model with tricycle gear and simplified controls is so easy to fly that people have soloed it after one day of instruction.

ONE APPLE OUT OF FIVE

is lost to the British grower and consumer every year through pests—fungi and insects! This country's apple growers spend about £3.5 million annually on pest control. But even so the value of the lost apple crop is roughly an identical figure.

Much is being done to reduce this appalling loss to our economy—over 100,000 tons of apples, plums, pears and cherries each year. New chemicals, new methods are making their appearance. One of them is **low-volume spraying** and one of its pioneers is the MICRON SPRAYER, shown here in action in a Kentish apple orchard. It does the job with 10-15 gallons of 'atomized' spray liquid per acre where roughly 20 times this figure is used by orthodox methods of application.

Let us tell you more about it! Write or 'phone—

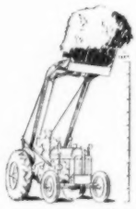
CLEAN CROPS LIMITED

193 PALACE CHAMBERS · BRIDGE STREET · S.W.1

(WHitehall 8854)

---

for EXTRA height



The Horn-draulic will raise loads up to 11 feet, a very useful asset especially at the beet harvest, or to 20 feet with the loader boom attachment.

for EXTRA power

The Horn-draulic will lift up to 1600 lb. with complete stability. With this power the farmer can speed up his jobs and save labour.

for EXTRA jobs

With its great variety of attachments the Horn-draulic will dig, load, cut and carry, proving itself to be more than just a loader—it's a machine that goes on saving all the year round.

It's* TWICE *the loader—it's

Horn-draulic

For Fordson Major (Old and New Model), *Ferguson, David Brown, Nuffield* (fitted with heavy duty tyres), *International M or H, Turner, Allis-Chalmers.*

STEEL FABRICATORS (CARDIFF) LTD., ROATH, CARDIFF

Export Department: Steel Fabricators (Overseas) Ltd., 7 Chesterfield Gardens, London, W.1. Cables: 'Africover', London

M-W.69

BOFECC

We are specialists in the export of British agricultural machinery, transport pumps, diesel engines, generating sets, etc., and represent in various markets, particularly the Middle East and Africa, a number of leading manufacturers, for whom we have secured substantial contracts.

***We offer specialised experience** to overseas clients wishing to purchase British machinery, and we arrange financing of British machinery exports where necessary.*

***To British manufacturers,** our own overseas organisation ensures energetic sales and thorough service and maintenance facilities.*

THE BRITISH OVERSEAS ENGINEERING & CONSTRUCTION CORPORATION LTD

28 ECCLESTON STREET · LONDON SWI

FERTILISERS
WEED KILLERS
INSECTICIDES

HARDY

M. W. HARDY & CO (MERCANTILE) LTD

PINNERS HALL, GT. WINCHESTER STREET

LONDON EC2 TEL: LONDON WALL 7131

NEW YORK: M. W. HARDY & CO. INC.

141 BROADWAY, NEW YORK

PESTICIDES

Versatile, economical . . .

clinging

CALCIUM ARSENATE

Our low prices delivered c.i.f. your nearest port will surprise and please you

write or cable: **SFEC – LIMOGES – FRANCE**

OLIVER

Self-Propelled Combines

Cut Grain Losses . . . Harvest Faster

The Oliver Model "33" Self-Propelled Combine brings new speed and efficiency to harvesting. It does both cutting and threshing in one operation . . . greatly reducing grain losses and saving valuable time.

More than 100 years of manufacturing experience have enabled Oliver to make the Model "33" Combine a more advanced and rugged machine. It has the power and stability for easy travel over irrigated and terraced land, across ditches and borders. Self-propelled and driven by one operator, it frees tractors and man power for other farm work. See your Oliver Distributor about immediate delivery of Oliver tractors and implements.

Oliver "33" Combine is also available with sacker attachment and platform instead of grain tank, as shown.

The Oliver Model "15" tractor-drawn combine can be operated by a separate engine or by the Direct Drive Power Take-Off on Oliver Tractors.

OLIVER

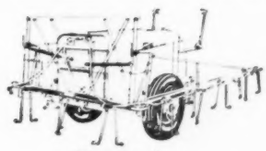
THE **OLIVER** CORPORATION

Export Division
400 W. Madison St., Chicago 6, Illinois, U.S.A.

"FINEST IN FARM MACHINERY"

Oliver Iron Age Mounted Duster

Oliver Model "8" Baler



Oliver Iron Age Pull Type Sprayer

Ideal FOR TOBACCO

'ARWELL'

Atomizing Sprayer and Duster

The ARWELL ATOMIZING SPRAYER AND DUSTER will spray liquid, powder or BOTH. Simply designed, strongly built to give long life and trouble-free service. Ideal also for Fruit Growers, Hop Growers, Market Gardeners, and Nurserymen, Estate Owners, and on Farms and Smallholdings.

Specially designed for spraying and dusting trees, shrubs, lawns, and row crops to prevent animal and insect pests and for fungus disease control. Can also be used for whitewashing buildings, fences and trees and pressure washing of equipment and floors.

Equipped with a pump, jet and air fan and when the liquid leaves the spraying jet it is carried by an air blast which atomizes the spray, and because of this far less liquid is needed for the same area than would be required with the standard method. Can also be used for dry and wet dusting.

Sole Overseas Distributors:

Joseph Pyke & Son (Liverpool) Ltd

BURY COURT HOUSE, BURY COURT, LONDON, E.C.3

Cables: "Jospyke," London *Telephone: Avenue 3811*

MODEL "B" Fitted two 16" x 4" pneumatic tyred wheels for hand operation.

MODEL "A" Mounted for any type tractor with hydraulic lift attachment. Controlled from seat.

The **KENNEDY & KEMPE**

GRAIN DRIER

DEALS with the output of a 12ft. Combine Harvester, drying the grain and pneumatically elevating it with one Fan. It can be arranged to elevate the wet grain from a pit (illustrated) or a small hopper. Firing by Coke or Oil. Average output 1½ tons per hour. The exhaust air from the Fan can be used to pass the dried grain direct to Silos. Our technical staff is available to advise you without obligation.

Over 500 K & K Grain Driers are in operation at Home and Abroad

KENNEDY & KEMPE LTD.

MANUFACTURERS OF GRASS AND GRAIN DRIERS

Harewood Forest Works, Longparish, Andover, Hants

Telephone: Longparish 224 *Telegrams: 'Kennedy, Longparish'*

Clifford

ROTARY CULTIVATOR

12", 16" and 22" models. Write for catalogue. We will arrange a demonstration through your local CLIFFORD Agent. Simple Hire Purchase terms.

FOR EVERY PURPOSE WHERE YOUR BIG TRACTORS CAN'T GO

For your kitchen garden, small plots and inter-row work, here is a FULL POWERED machine capable of CULTIVATING OR PLOUGHING to a good average depth. Twelve easily mounted attachments make it a complete system for small scale work—including rotary cultivating, ploughing, hoeing and potato spinning.

CLIFFORD AERO & AUTO LTD

Agricultural Division

(Sales Dept. 55), Cranmore Boulevard, Shirley, Birmingham

Development of new pasture land is one of the most important functions of Weedone Brush Killers.

This area can be turned into productive pasture at low cost with the help of Weedone Brush Killers.

WEEDONE® BRUSH KILLERS

The Modern, Inexpensive Way to Clear Pastures, Roadways, Rights-of-Way, Drainage Ditches

Here are just three of many reasons why Weedone® Brush Killers, the modern, selective chemical sprays, offer tremendous advantages over the older method of cutting brush by hand labor . . .

1. Weedone Brush Killers offer a simple and effective way of reclaiming pasture or farm land overgrown with weeds and woody plants.
2. Weedone Brush Killers do the work at much lower cost. One man with a sprayer can do the work of a dozen men with brush hooks. Spraying eliminates the need for buying and maintaining expensive machinery.
3. Weedone Brush Killers do not kill grass. After woody plants and weeds are killed, a grass cover grows and provides increased fodder, resulting in greater yields of meat and milk per acre.

SUPERIOR PRODUCTS USED IN ALL PARTS OF THE WORLD

Weedone Brush Killers contain the powerful, low-volatile butoxy ethanol ester of 2,4-D and 2,4,5-T. This combination, or Weedone 2,4,5-T alone, can be sprayed at any season, on growing or dormant plants, on foliage or on the base of the stems.

These outstanding brush killers are made by American Chemical Paint Company, originators of 2,4-D and 2,4,5-T weed and brush control. They were developed through our own extensive laboratory and field research. They have been proved on thousands of rights-of-way and pastures all over the world. You can depend on the effectiveness of Weedone Brush Killers.

KILL MORE THAN 100 WOODY PLANTS

Weedone Brush Killers kill most kinds of brush, including mesquite, marabou, aroma, and a wide variety of annual and perennial weeds. Weedone 2,4,5-T is particularly effective for the control of gorse and brambles such as wild blackberry.

THE RIGHT WEED KILLER FOR EVERY PURPOSE

Weedone LV-4. The powerful, low-volatile butoxy ethanol ester of 2,4-D. Minimizes danger of vapor damage to nearby susceptible plants. The greatest cropland herbicide.

Weedone Concentrates. Highly effective ethyl, isopropyl or butyl ester formulations of 2,4-D. Available for application where volatility is not a problem.

Weedar.® Highly concentrated formulations of the amine salts of 2,4-D.

Weedar MCP. The amine salt formulation of 2-methyl-4-chlorophenoxyacetic acid. For small grain crops underseeded with legumes.

Weedex. Sodium salt formulations of 2-methyl-4-chlorophenoxyacetic acid.

AMERICAN CHEMICAL PAINT COMPANY AMBLER, PA., U.S.A.

Originators of 2,4-D and 2,4,5-T Weed Killers

MANGANESE

The Importance of Manganese in the NUTRITION OF PLANTS AND ANIMALS

MANGANESE *is one of the so-called 'trace elements' essential to healthy plant and animal life*

Manganese sulphate is not the only manganese compound which has been successfully used in the control of manganese deficiency in plants and animals. It has been shown, for example, that the sulphate, carbonate, and dioxide are equally effective as preventives of perosis of chicks caused by manganese deficiency. Grades of manganese sulphate containing proportions of oxides may be used with confidence in the control of perosis.

Information about the use of manganese compounds as protectives against manganese deficiencies may be obtained from our Advisory Department. Local distributors should be contacted for supplies.

CHEMICAL AND CARBON PRODUCTS LIMITED

24 St. George Street · Hanover Square · London · W1

. . . and thereby releases your tractor and labour sooner for other jobs. The M. & G. Sight feed seed-drill is a continuous drill for all seeds up to and including peas. The units are made for easy attachment to all lifting tool-bars on 2, 3 or 4-wheel tractors.

Price **£9. 7s. per unit** including tool stalks

Manufacturers of single and spacing seed units, hand seed drills, single and double wheel push hoes, hoe units for tool bars, tubular light-weight gates, food mashers and humane killers for poultry etc.

Trade enquiries invited

Indispensable to all Smallholders and Market Gardeners

The M. & G. Hand Operated Sight Feed Seed Drill Price **£8. 5s.** Complete

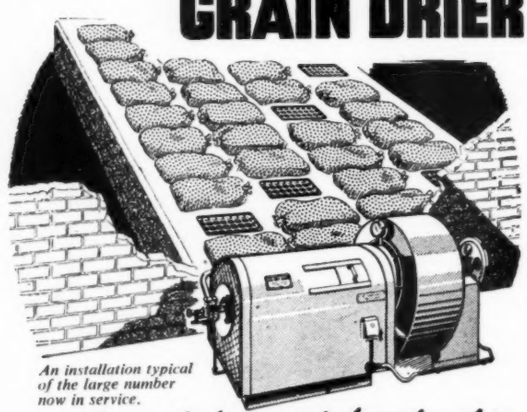
M & G LTD

Full details gladly sent on request.

M & G PRODUCTS LTD. 95 Charlotte St. BIRMINGHAM 3.

The **Nu-way** IN SACK

GRAIN DRIER



An installation typical of the large number now in service.

ends wet harvest head-aches

★ Will dry 50 1-cwt. sacks by 1% moisture reduction per hour, with no risk of over-heating ★ Running costs only a few shillings per ton of grain dried ★ Automatic cut-out to guard against power or flame failure ★ No pumps or compressors to give trouble ★ No finicky small jets to clog ★ Can be quickly and cheaply installed in almost any existing building ★ Fired by the exclusive Rotavac Oil Burner with one simple control ★ Performance proved by hundreds of enthusiastic owners ★ Distributors in every county.

£268 EX-WORKS

★ As reviewed in the Ministry of Agriculture Farm Machinery Leaflet No. 12

Write for full details from

NU-WAY HEATING PLANTS LTD., DROITWICH, WORCS.

WE'VE A COMPLETE LUBRICATION SERVICE

Right out here in the Bush . . .

Machines working under the most arduous conditions are sometimes miles from the nearest service station. But this problem of adequate lubrication in remote places can be overcome by using a Tecalemit Field Service Unit.

Operational from its transporting lorry and completely mobile, the Field Service Unit gives you all the facilities of the latest Tecalemit lubricating equipment. It can also be unloaded and set up at any convenient spot, providing a modern, efficient lubrication service.

You may not be within easy reach of civilisation . . . but you can bring civilisation to you with a Tecalemit Field Service Unit.

TECALEMIT

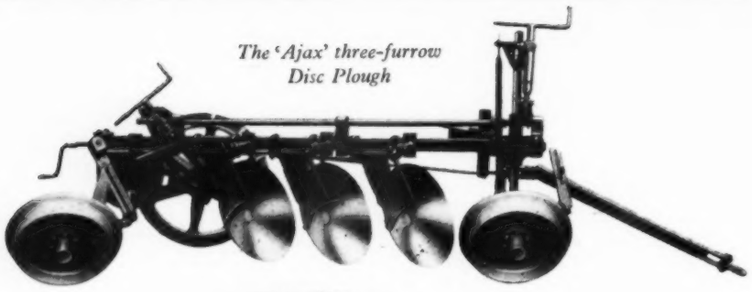
The Authority on Lubrication

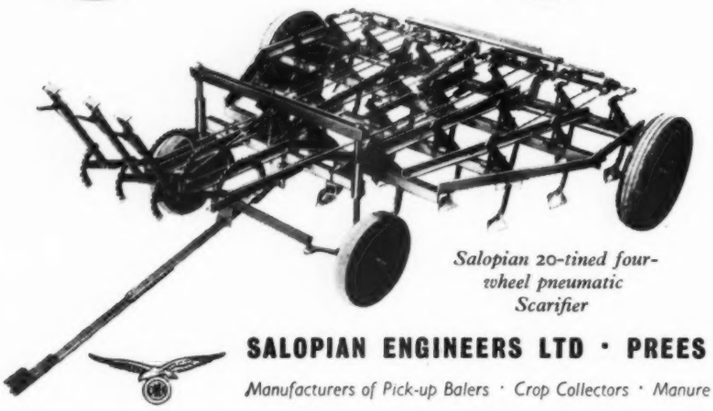
PLYMOUTH, ENGLAND

1367

SALOPIAN *for really tough jobs-*

The 'Ajax' three-furrow Disc Plough





Salopian 20-tined four-wheel pneumatic Scarifier

DISC PLOUGHS

Salopian Disc Ploughs will penetrate to any depth required, within the range, without 'crabbing', giving wide deep furrows in any soil conditions. Exceptional clearance is provided between the discs, the wheels and under the frame—there are no obstructions to gather trash. Strongly constructed for heavy duty work. Leaflet on request.

SCARIFIERS

Where there is fallow ground to be broken, worked, weeded or generally cultivated, no other machine is so reliable or economical as the Salopian Stump Jump Scarifier. Robust three-point suspension. Interchangeable widely spaced tines. An extensive range of depth adjustments readily obtainable for all working conditions. Send for leaflet.

SALOPIAN ENGINEERS LTD · PREES · SHROPSHIRE · Telephone PREES 331-4

Manufacturers of Pick-up Balers · Crop Collectors · Manure Spreaders · Disc Ploughs · Farm Buildings · Cowhouse Equipment etc.

We are able to offer for immediate shipment

RECONDITIONED TRACTORS

completely overhauled, warranted, and finished as new, at very reasonable prices

FORDSON MAJOR
ALLIS CHALMERS Model B
FERGUSON and other makes

Sample tractors dispatched on special terms to any part of the world

HALSE'S *of* HONITON

Agricultural Engineers

HONITON · DEVON · ENGLAND

SCOTMEC

GRINDS EVERYTHING GRINDABLE

NEW "TWO-TONNER" HAMMER MILL

grinds over 2 tons per hour

Recommended for 25 h.p. to 40 h.p. tractor, diesel or electric drive

Incorporating all the usual SCOTMEC features

PLUS . . .

(1) Bulk Feed Top (extending to a width of 13 inches) allows full use to be made of the large grinding capacity for sheaves, dried grass, corn on the cob, etc.

(2) Huge combined Chute-Hopper with "Micro" Feed rate setting to suit available power, screens and the moisture content of the grain.

(3) Safe and convenient hand feeding through adjustable chute angle and swinging safety flap.

Price, ex-Works — £112 10s. 0d.

Write to us for details of Trade Discounts and further information

SCOTMEC HAMMER MILL

SCOTMEC WORKS AYR SCOTLAND

• big economies in • copper and • sulphur

new ways with bordeaux mixtures, etc.

Late blight of potatoes can be controlled with organo-mercury compounds alone. At the same time there are many troubles where an organo-mercury may be a co-partner in, for instance, bordeaux mixtures or sulphur preparations — improving the fungicidal power and offering a big economy, since the equivalent of 1 lb. of mercury will save 75 to 100 lbs. of copper or 100 to 200 lbs. of sulphur. This new technique with old friends appears to have big possibilities and we shall be happy to advise.

We also make wettable powders such as D.D.T., Lindane and Sulphur

F. W. BERK & CO. LTD.

THE MERCURY SPECIALISTS

1/19 NEW OXFORD STREET, LONDON, W.C.1

and at Tilgate Research Station, Sussex

TAS/BK.306

'The World's finest Copper Fungicide'

Control LEAF SPOT OF BANANAS

'Leaf Spot' or 'Sigatoka' disease seriously affects the Banana Crop in many zones. Not only are the yield and finger size reduced, but this disease also causes variability in ripening of the fruit.

Regular spraying with **'FYTOLAN'** controls 'Leaf Spot', and gives greater yields of uniform fruit.

'FYTOLAN' is a highly concentrated copper fungicide containing copper oxychloride in its most effective form. The special wetters and stickers used in **'FYTOLAN'** ensure that it mixes instantly with water, gives a perfect suspension. **'FYTOLAN'** is extremely rain resistant and stays on the leaf.

It leaves no sediment in the tanks **and all the 'FYTOLAN' put in the spray tanks goes on to the crop.**

by spraying with

'FYTOLAN'

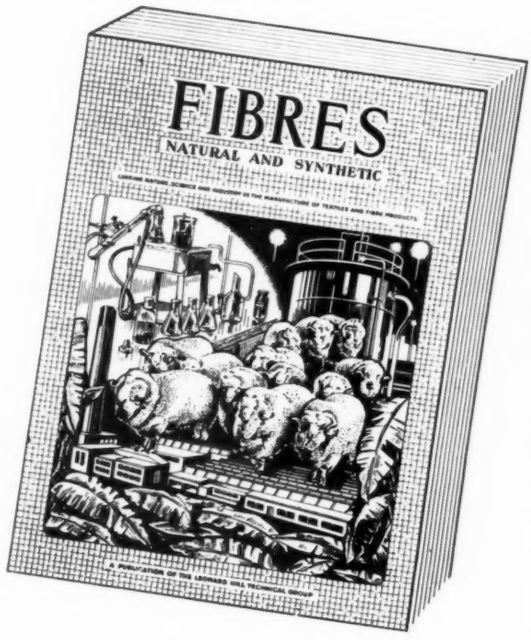
COPPER FUNGICIDE

TRADE MARK

Write for full details to :— **BAYER AGRICULTURE LTD · THORNYCROFT HOUSE · SMITH SQUARE · LONDON · SW1**

A New World Industry

of the science and chemical treatment in the production and usage of *FIBRES, Natural and Synthetic,* now the most modern industrial development.



FIBRES, Natural and Synthetic, gives, each month, a review of the latest technical developments all over the world, presented in a concise yet comprehensive form, providing a monthly record of international progress in fibres.

Qualified correspondents in all the world's important fibres producing and using countries contribute to ***FIBRES, Natural and Synthetic,*** on new developments in materials, machinery and research.

A Publication of the LEONARD HILL TECHNICAL GROUP

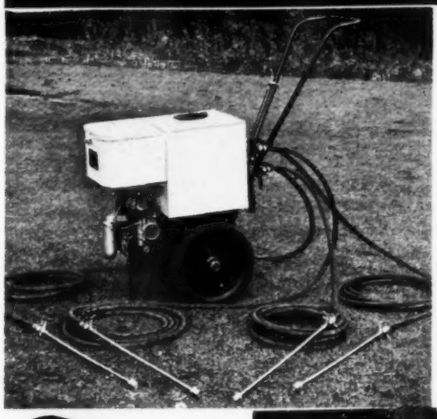
For details, write

FIBRES

NATURAL AND SYNTHETIC

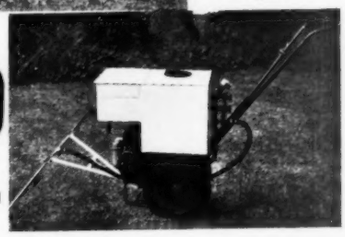
STRATFORD HOUSE EDEN STREET
LONDON, N.W.1 EUSTON 5911

EXCEPTIONAL ADVANTAGES OF THE *Four Oaks* MECHANIZED SPRAYER



- Pneumatic tyres
- Weight only 80 lb.
- Overall width only 12 in.
- Robust construction
- High performance
- Draws liquid from own 6 gallon tank or separate supply
- Petrol consumption up to 12 hrs. to one gallon
- Full range of various spraying attachments
- Prompt delivery

Illustrated brochure on request



THE *Four Oaks* SPRAYING MACHINE CO. LTD., BIRMINGHAM

Phone : Four Oaks 305 & 1560
Grams : Sprayers, Four Oaks

DESIGNED *for all* WEATHERS

Cabs for Ferguson, Fordson and other Tractors. Made of light aluminium alloy extruded sections and sheet, these Cabs are easily fitted and removed, stand up to very hard wear and give full protection with excellent visibility. Windows are of toughened safety glass throughout. A tropical version with double roof and no windows can be supplied.

PRICES FROM £36 - 0 - 0

Apply to Agent or direct to Manufacturers

SCOTTISH AVIATION LTD

PRESTWICK · AYRSHIRE

Buckner Sprinklers

the heart of your irrigation

The world's most dependable sprinkler heads are made by Buckner. Precision-made, field-tested, fully guaranteed!

Whether you have a portable or permanent irrigation system, the life of your irrigation system depends on your sprinkler head. Protect your investment **and your crops** with trouble-free, long-lifed BUCKNER Sprinklers.

HERE'S HELP IN YOUR IRRIGATION PROBLEMS

Free planning folders

Buckner's Planning Department is constantly available as a consulting service for your own installation plans.

Today write

L. C. CLARK

PERFECT WATER

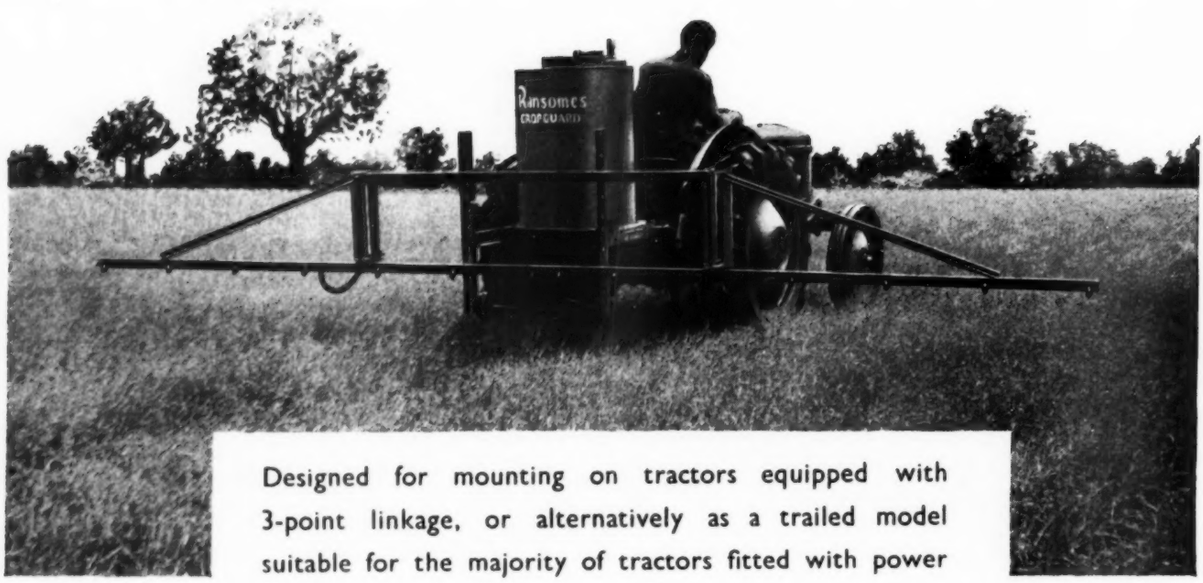
BUCKNER MANUFACTURING CO.

CURTAIN SPRINKLERS

P. O. Box 232 Fresno, California, U.S.A.

Ransomes

'CROPGUARD' SPRAYER



Designed for mounting on tractors equipped with 3-point linkage, or alternatively as a trailed model suitable for the majority of tractors fitted with power take-off.

Thousands of farmers are solving their weed control problem, and increasing their yields, by using this efficient and fool-proof sprayer. Its sound design and robust construction ensure reliability and long life.

Ransomes' Products include : Tractor and Animal Ploughs, Cultivators, Disc Harrows, Toolbar Frames, Subsoilers, Mole Drainers, Potato Diggers, Peanut Pickers, Thrashers, Balers, Maize Shellers, Crop Driers, etc.

Ransomes *for Reliability*

RANSOMES SIMS & JEFFERIES, LTD., ORWELL WORKS, IPSWICH

BETTER SPRAY THE RANSOMES WAY

CLASSIFIED ADVERTISEMENTS

3/- A LINE. MINIMUM 8/-
BOX NUMBERS 1/- EXTRA
Address Box Numbers to:

WHEN ADDRESSING ENQUIRIES TO THE ADVERTISERS
PLEASE MENTION

'WORLD CROPS,' STRATFORD HOUSE, 9 EDEN STREET, LONDON, N.W.1

OFFICIAL APPOINTMENTS

TEA Research Institute of Ceylon. An immediate vacancy exists for the post of AGRICULTURAL CHEMIST in this Institute. The primary duty of the officer appointed will be, in broad terms, to carry out research on the nutrition of tea as a crop grown on Ceylon soils. Facilities for research work are excellent, comprising well-equipped laboratories, an experimental tea estate of 420 acres, and reasonably adequate funds. In filling the post consideration will also be given to experience with advisory work to farmers or planters.

The initial salary will be commensurate with the appointed officer's record and experience. The basic scale of salary offered is Rs.12,000-Rs.600-Rs.24,000 per annum (Rs 1 is equivalent to 1s. 6d.). In addition a dearness (cost-of-living) allowance is payable which at present is approximately Rs.5,800 per annum for a married man and Rs.3,300 for a single man. A free house with heavy furniture will be provided The officer appointed will be required to contribute to the Ceylon Planters' Provident Society at a rate of not less than 10 per cent. and not more than 15 per cent. of basic salary. Contribution to the fund by the Board will be at the rate of 15 per cent. of basic salary. The appointment is non-pensionable.

Home leave will be granted at the rate of eight months' leave after each fifty-two months' service in Ceylon. After ten years' tropical service the interval between leaves will be reduced to forty months.

The Institute is situated at an elevation of about 4,500 ft. in the hills of Ceylon where pleasant and healthy climatic conditions prevail.

Requests for further information, or applications giving full details of previous technical training and experience, together with the names of three referees, should be sent as soon as possible to the Director, Tea Research Institute of Ceylon, Talawakelle, Ceylon.

MYCOLOGIST, Forest Department, Kenya (CSC. 61/7/01). To study pathology in forests and plantations and the fungal diseases of timber. Candidates must be male and possess an Honours Degree in Botany with experience of research in mycology and economic botany. A degree or diploma in forestry would be an advantage. Appointment will be permanent and pensionable after two years' probation. Salary in the scale £585-£1,320, with a cost-of-living allowance, at present 25 per cent. of salary, to a maximum of £250 per annum. Quarters provided, if available, at moderate rental. Free passages for officer and family on appointment and leave up to maximum of three adult passages. Taxation at local rates. Generous home leave. Free medical attention.

Intending candidates should apply in writing to the Director of Recruitment (Colonial Service), Colonial Office, Sanctuary Buildings, Great Smith Street, S.W.1, giving brief details of their age, qualifications, and experience. They should mention this paper and quote the reference number shown against the post for which application is made.

HER MAJESTY'S COLONIAL SERVICE

APPLICATIONS are invited for the following post: AGRICULTURIST, Somaliland Protectorate (CSC. 63/5/01), to take charge of experimental scheme for date cultivation with a view to its eventual expansion. Candidates should hold degree or diploma in Agriculture and have expert knowledge of commercial date cultivation. Candidates without such experience are not desired. Salary up to £1,600 per annum, according to qualification and experience, for contract of about three years. Also cost-of-living allowance maximum £100 per annum. Free passages for officer, wife and not more than two children. Quarters provided for moderate rental. Somaliland has no income tax at present. Generous paid leave at end of contract.

Intending candidates should apply in writing to the Director of Recruitment (Colonial Service), Colonial Office, Sanctuary Buildings, Great Smith Street, S.W.1, giving brief details of their age, qualifications and experience. They should mention this paper and quote the reference number (CSC. 63/5/01).

THE Land Settlement Association Ltd. invites applications for post of DEPUTY CONTROLLER (£1,200 rising to £1,400) in London. Work mainly organisation of smallholdings on basis of centralised services (marketing, machinery, labour and supplies) on behalf of Minister of Agriculture and in consultation with tenants, and comprises administration, production and financial policy and negotiations with tenants. Some travelling involved. Applicants should possess practical knowledge of agriculture or horticulture and of agricultural legislation. Administrative experience (including work in committees) essential. Experience of estate management valuable. Age 30 to 40. Contributory pension scheme.

Full particulars and application form from Secretary, Land Settlement Association Ltd., 43 Cromwell Road, S.W.7.

OFFICIAL APPOINTMENTS

NATIONAL Institute of Agricultural Botany. Applications are invited for the following vacancies on the staff of the Institute:—

(*a*) ASSISTANT to the Chief Officer of the Official Seed Testing Station for England and Wales. Candidates for this post should hold a degree in botany or natural science and have had some training in plant pathology. Commencing salary £520, by annual increments, subject to satisfactory service, to £835 per annum, plus a pay addition of 10 per cent. on the first £500 and 5 per cent. on the remainder.

(*b*) RESEARCH ASSISTANT in the Official Seed Testing Station for England and Wales. Candidates for this post should hold a degree in botany or natural science. Commencing salary at age 25 £390, by annual increments, subject to satisfactory service, to £670 per annum, plus a pay addition of 10 per cent. on the first £500 and 5 per cent. on the remainder.

Both these posts involve an obligation to participate in the Institute's superannuation scheme under the Federated Superannuation System for Universities.

Full particulars and forms of application in relation to the above posts are obtainable from M. G. Tozer, Secretary, National Institute of Agricultural Botany, Huntingdon Road, Cambridge.

HER MAJESTY'S COLONIAL SERVICE

APPLICATIONS are invited for the following post: CIVIL ENGINEER, Hydrological Survey Department, Uganda. C.S.D. 64/9/01.

Duties: Collection of data, survey and design for irrigation and drainage schemes.

Appointments on contract for 2½ to 3 years in scale £830 to £1,590, plus gratuity.

Candidates, who should be between 25 and 40 years of age, should hold a University degree or diploma in engineering which carries exemption from Parts A and B of the Institution of Civil Engineers examination, plus at least two years' approved practical experience in engineering, or be corporate members of the Institution of Civil Engineers.

Further particulars available on application to the Director of Recruitment (Colonial Service), Colonial Office, Sanctuary Buildings, Great Smith Street, S.W.1. Candidates should state briefly their age, qualifications and experience, mentioning this paper and reference No. C.S.D. 64/9/01.

SUDAN Government. The Ministry of Agriculture invites applications for the following posts in the Engineering Division which constructs and operates pump irrigation schemes, ginning factories, mechanised agricultural schemes, earthworking machinery, etc.

"415."—SENIOR MECHANICAL ENGINEER, who should have a good degree in engineering or corporate membership of the Institution of Mechanical Engineers and administrative experience. Age 40 to 45, but candidates outside these limits may be considered. Salary range, £E 1,825 to £E 2,330 (annual increments). Appointment will be made with a view to early promotion to Chief Engineer.

"416."—ENGINEER MANAGER to take charge of the running and maintenance of caterpillar and other excavating and roadmaking machinery and agricultural tractors and implements. Degree in mechanical engineering or A.M.I.Mech.E. or long relevant experience required. Experience in administration and running of workshops and detailed knowledge of the type of plant operated is essential. Age 35 to 40, but candidates outside these limits may be considered. Salary range, £E 1,525 to £E 1,975 (annual increments).

Both the above appointments will be on probation for short-term contract (with bonus) for up to six years. Starting rate would be determined according to age, qualifications and experience. Outfit allowance of £E 50 on appointment. Free passage both ways by air for official and family. Cost-of-living allowance, which is reviewed quarterly, may also be payable. There is at present no Income Tax in the Sudan.

Further information and application form will be sent on receipt of a postcard only, addressed to the Sudan Agent in London, Wellington House, Buckingham Gate, London, S.W.1, quoting "Senior Mechanical Engineer 415" or "Engineer Manager 416," as the case may be, and name and address in block letters.

SITUATIONS VACANT

GOOD ALL-ROUND MECHANIC wanted for lady's home farm and estate; able to overhaul tractors and all farm machinery, including motors, and make himself generally useful on estate. Nice cottage, with electric light, main water, bath, etc. Good refs. essential.—Apply F. Palmer, Clevedon, Wokingham, Berks.

SITUATIONS VACANT

MYCOLOGIST required by commercial organisation in Southern England for experimental and supervisory work. Good commencing salary, according to experience and qualifications. Applicants should be not less than 35 years of age, M.Sc. or equivalent.—Write, giving full details in confidence, Box 5022, c/o WORLD CROPS.

EDWARD WEBB & SONS (STOURBRIDGE), LTD., have vacancies for Agents to sell their pedigree seeds and compound Fertilisers on commission in the following areas: East Hertfordshire, West Hertfordshire, South Bedfordshire and western area of the Isle of Ely.—Applications should be made to their Head Office at Wordsley, Stourbridge, Worcs.

SITUATIONS WANTED

TEA PLANTER (contemplating retirement from India) with exceptionally wide experience, having managed, inspected or reported upon nearly 30,000 acres of tea, seeks salaried post where his knowledge will be of use; or assistance to establish production of Eastern produce in the Colonies.—Box No. 5019.

TEA PLANTER, Manager, Engineer, returning to the United Kingdom Autumn 1952, wishes salaried employment in agricultural line. Agricultural experience and connections North of Scotland.—BOX 5020, c/o WORLD CROPS.

AGRIC. GRADUATE, 4 years' University training, wishes to hear of vacancies on the technical or advisory staffs of Agricultural concerns in Britain, Europe, Middle East or East Africa.—Apply Box 5024, c/o WORLD CROPS.

FOR SALE

OPPERMAN 'Quickgrip' Tractor Strakes. The only completely successful method of positive wheelgrip and ploughing efficiency under the worst soil conditions. Made to fit all the leading makes: Fordson Major, Nuffield, David Brown, Case, Ferguson, Farmall, Moline V, etc. Prices from £31 per set. Wheel sizes accordingly. —Fullest particulars from S. E. Opperman Ltd., Stirling Corner, Boreham Wood, Herts. ELStree 2021.

IRRIGATION. For sale, owner retiring, Sigmund Rainer Plant, 15 h.p. Turner diesel pumping set 4 rainers, 1,500 ft. 3-in. pipe (aluminium), 950 ft. 4-in. ditto, together with fittings as used.—Scutt, Badlesmere Court, Faversham, Kent.

FERGUSON Tractor Owners should fit a Wallace Sideland Adjusting Lever to their tractor ploughs; instant adjustments can be made on Sideland without leaving tractor seat. Available for Ford/Ferguson single- and double-furrow ploughs and Standard Ferguson single- and double-furrow ploughs. Price £5 10s., carriage paid.—Full particulars from John Wallace & Sons (Ayr), Ltd., Townhead Works, Ayr. Tel.: Ayr 5018/9.

EX-W.D. TRUCKS. If you are interested in G.M.C., Dodge, Austin, Ford, Chevrolet. Any capacity up to 12 tons. Four-wheel drive, six-wheel drive or rear wheel drive only.—L. H. Sworder (Motors), Exporters of Trucks, Lane End, High Wycombe, Bucks.

PUMPS for all purposes, new and reconditioned.—The Greenwich Pump & Plant Co., Ltd., Denham Street, Greenwich, S.E.10.

ELECTRIC MAINS WELDERS, operate from 20 amp. meter, any voltage, £55 with condenser, etc. Demonstrations daily.—Production Promotion, 94 Camden Road, N.W.1.

DUSTS or Carriers, use our Airfloated BALL CLAYS, very adherent, great spread, with Brownian Movement, low price, samples.—Henshaw & Co., 97 Clearmont Road, Weymouth.

LAND ROVER. The distributors and specialists can offer immediate delivery of 1949 and 1950 models.—Arnold G. Wilson, Ltd., 232 Harrogate Road, Leeds, 7. Tel. 41014-5.

VULCAN HYDRAULIC RAMS pump water automatically. — Green & Carter, Ltd., Winchester, England.

TRACTOR TYRES. As new, to clear; 9.00 × 24, 10 × 28, 11.25 × 24, 12.00 × 28, 13 × 24, 5.50 × 17; send for details.—St. Mary's Motor Co., Market Harborough.

CLASSIFIED ADVERTISEMENTS

FOR SALE

TO be a Farmer's Boy—and live in a Languard—a palace on wheels. £828 (cash or terms). Illustrated details and nearest agent.—Country Life Caravan Co., Romsey, Hants.

REPLACEMENT ENGINES, fully reconditioned, are available as follows: Wisconsin VE4 for New Holland baler, Wisconsin VF4 for M.M.69 combine harvester, Meadows four-cylinder 28-h.p. for M.M. G.8 combine harvester, KEF for M.M. Model U tractor; full particulars on request.—Sale 'Tilney (Agricultural & Industrial) Ltd., Barkham Road, Wokingham, Berks. Tel. Wokingham 910.

VERTICAL CROSS TUBE BOILERS. New heavy vertical cross tube boilers in stock, for early delivery, all sizes, 4 ft. × 2 ft. to 13 ft. × 6 ft.; also reconditioned boilers.—The Grantham Boiler & Crank Co. Ltd., Grantham, Lincs.

FORDSON MAJOR, 1948, pneumatics 1100 x 36, p.t.o., E. & H. carburettor, petrol and v.o.; £150.—Islip Pedigree Breeding Centre, Islip, Oxford. Charlton-on-Otmoor 42.

JEEPS, reconditioned throughout, 20-23 m.p.g.; guaranteed 6 months; luxurious utility; all original spares stocks.—Metamet, 100 Belsize Lane, N.W.3. Hampstead 8231-2.

TYRES and tubes, used, 13 in., 14 in., 15 in., 16 in., 17 in., 18 in., 19 in., 20 in., 21 in.; also tractor, commercial, ex-W.D., beaded and odd sizes, and wheels, all types.—Cook, 141 Badminton Road, Downend, Bristol.

UNIVERSAL CAR DISTRIBUTORS (LONDON) LTD. Jeep spare parts, home and export, all spares stocked, exchange plan engine, gear box, water pump, etc., new hoods, gasket sets, brake linings, etc., etc.—331-333 High Road, Chiswick, London, W.4. Chiswick 1919.

EX-MINISTRY VEHICLES AND SPARES, suitable for farm work, at competitive prices.—Robert Dixon Ltd., Hunsdon Aerodrome, Herts. Tel. Stanstead Abbotts 237.

RECONDITIONED TRACKS on a service exchange basis are available for Cat. D2, D4 and D6 machines; also Int. TD6, TD9, TD40 and TD14 machines. Keep a careful check on your tracks—watch the links before they wear too thin. Our engineers will always be pleased to call and advise you without obligation. Write for our latest price list and illustrated folder; the finest equipped track reconditioning workshops in the world—only the best craftsmen employed.—Dilloways, Southall. Tel.: Southall 3494/5/6.

THE world's leading Light Tractor is the Iron Horse (6 h.p.). Write to us for detailed proof and for particulars of the first and best "Motor Hoe" on the market.—British Anzani Eng. Co., Ltd., Hampton Hill, Middlesex.

FOSTER 54 in. THRESHER, new, immediate delivery.—Reynolds, 85 Newnham Avenue. Tel.: Bedford 67912.

STANDEN BEET TOPPER for Ferguson for sale.—Reekie Engineering Co., Arbroath.

RECONDITIONED DAVID BROWN TRACTORS. Appearance and specifications almost equal to new. Guarantee similar to manufacturers. Price less than half. Full details on request.—Belton Bros. & Drury, Ltd., Eastoft, Scunthorpe, Lincs. Tel.: Eastoft 33/34.

CROP SPRAYERS. The 'Mistifier' all-purpose range all chemicals, 5-100 galls. per acre. Prompt delivery, demonstrations arranged.—Drake & Fletcher, Ltd., Maidstone.

INTERNATIONAL T.D.9, wide gauge Crawler Tractor, 16 in. track plates, first-class order, £875; 1951 David Brown Cropmaster Diesel Tractor, fitted electric lights, self-starter, hydraulic lift, pulley and p.t.o., £485.—Williams, Tractors, Rushden. Tel.: 2642.

SECOND-HAND ALFA-LAVAL MILKING PLANT for sale. Three-bucket system, piping for twelve standings, three-phase motor. Enquiries to be sent to Messrs. Strutt & Parker, of Coval Hall, Chelmsford, from whom further particulars can be given.

VILLIERS NEW 1952 ENGINES AND SPARES, immediate delivery. New farm and industrial two- and four-stroke engines from £16 4s.; new autocycle and motor cycle engine units, from £24, prices ex-works; new 1952 Villiers-engined autocycles, from £63 17s., and light motor cycles from £76, purchase tax paid. Every available spare part for every type Villiers engine stocked.—Meeten's, Ltd., Official London Area Distributors, Shannon Corner, New Malden, Surrey. Tel. 3110.

BRISTOL 20-in. ANGLEDOZERS, Fowler Mark V.F. and Angledozer, D.4, D.7 and D.8s with scrapers and angledozers.—Wrights, Alton, Hants.

ADVERTISERS

KINDLY NOTE NEW RATES FOR

CLASSIFIED INSERTIONS

MISCELLANEOUS SALES

PLOUGH SHARES. A best quality chilled cast iron. Equivalent Ransomes U.D. 93, 120/- per doz. Carriage paid.—Thos. P. Headland Ltd., Loughborough Street, London, S.E.11.

PUMPS.—New Government Surplus Diaphragm Lift and Force for water, sewage, thick and gritty liquids, etc., 2in. inlet and outlet 950 g.p.h.; immediate delivery; £5/2/6; hose also in stock.—The Sterling Pump Co. Ltd., Spalding. Tel. Spalding 2404.

JEEP (Willys) fitted with very strong coachbuilt body, in very nice order throughout; Dunlopillo seats, tyres as new; price £325.—F. S. Sworder (Motors), Lane End, High Wycombe, Bucks. 'Phone Lane End 234.

COMBINE HARVESTER OWNERS reduce your operating costs by fitting a B.E.C. Paraffin Vaporiser. Available for Massey-Harris No. 726 8ft., and No. 21 12ft. machines.—Distributors—Geo. Brown's Implements Ltd., Leighton Buzzard. Phone 2062-3-4 (3 lines).

SPARE PARTS We believe that our stock of Austin, David Brown, Marshall Fowler spare parts is one of the most comprehensive in the United Kingdom.—Tom Norton, Llandrindod Wells.

FOX FORAGE HARVESTER, p.t.o. 4B model complete with cutter bar and pick-up attachment; £475.—Glentworth Scottish Farms Ltd., Glentworth, Gainsborough, Lincs. Tel. Hemswell 265.

TYRES and Tubes, part-used, all 13in., 14in., 15in., 16in., 17in., 18in., 19in., 20in., 21in.; also tractor, commercial, ex-W.D., beaded and odd sizes; and Wheels, all types.—Cook, 141 Badminton Road, Downend, Bristol.

PRICE REDUCTION SILOFIX PROOFED PAPER. 100 yards roll, 5 feet wide, £7 6s.; 50 yards roll, 5 feet wide, £3 14s. Protect your silo, stack, clamps, etc., from soil contamination, rain and frost.—Mitchell Colman & Co., Ltd., Holborn Hall, Clerkenwell Road, London, E.C.1.

TUBULAR STEEL FENCING POSTS. 5/12ft. lengths, holed for wire, flattened one end, 1¼ in., 2in. dia., 10d. per ft., 2in/3in. dia., 1/2 per ft., special prices for large quantities.—Fred Watkins, Coleford, Glos.

WHITLOCK MASH MIXERS, also Cafeteria laying Batteries, the Whitlock Sarson Brooder, etc. List P/1 Free.—Whitlock, Great Yeldham, Essex. 'Phone 305.

PORTABLE PIG FENCING, Trobridge Hurdles. 9ft., English oak throughout, complete with couplings, 30/9, ex works; illustrated particulars on request from original patentees.—Pig Breeders Supply Co., Checkenden, Reading.

TIGER CUB FLAME GUNS kill weeds where they stand and seeds where they land. Destroy all pestiferous growth. Flame giving heat in excess of 2,000 deg. using vaporising oil, paraffin or diesel oil. Prompt delivery. Send for leaflet to manufacturers.—Morton (W.) Longley Ltd., Hillingdon, Middx.

DAVID BROWN TRACTORS. New and second-hand tractors with full range of power lift implements. Hire Purchase terms. Express spare parts service.—Bromsgrove Motors, Ltd., Agricultural Engineers and Distributors, Bromsgrove. (Tel. 2741-2), Worcs.

DO you want a handysize baler to take out into the field for tripod work? The Opperman Light-Weight Motorised Portable Baler is ideal for this purpose. Details from S. E. Opperman Ltd., Stirling Corner, Boreham Wood, Herts.

ALL-WEATHER METAL CABS for Ferguson, Ford with Ferguson system, Ford 8 N.A.N. and Fordson Major tractors. Send for illustrated folder and prices. Weathershields Ltd., Bishop Street, Birmingham 5.

ROUND PEELED FIR STAKES, all lengths, 2 in./3 in. diameter tops, pointed for driving and creosoted under pressure. Also riven Oak Stakes, riven Ash Rails etc.—Calders Ltd., London Road, Boston, Lincs.

MISCELLANEOUS SALES

NOW that tyres are so expensive to replace, why not have one of our cheap conversions to use during the dry season and for rough jobs, road hauling work, etc., and thus save your good tractor tyres for when they are most needed. £25 0s. 0d. carriage paid, C.W.O., per complete set of part-worn tyres, wheels and hub centres; ready to fit your standard Fordson. For 11.25-24 we supply 13.50/14.00-20. For 11.25-28 we supply 15.00-20. Rubber By-Products (Warwickshire), Ltd., 86 Holloway Head, Birmingham 1.

THE FIRST SUCCESSFUL light agricultural transport—the Opperman Motocart, 8 h.p., 12 m.p.h., 30 cwt. load, economical air-cooled engine, maintenance negligible. Specially packed for delivery to any part of the world. Fullest particulars, literature, prices, etc., from S. E. Opperman, Ltd., Stirling Corner, Boreham Wood, Herts, England.

RABBIT NETS, best quality hemp, 3½ft., 10/3; 4ft., 11/3 per doz.; corded, 1/3 extra. Long Nets, 50yds. x 3ft., fitted, 37/6 each. Snares, 17/6 gross, carr. paid, C.W.O.—Redport Net Co., Asker Works, East St., Bridport, Dorset.

OAK FIELD GATES bolted, creosoted, 8 ft., 8 ft. 6 in., 45s., 9 ft. 50s., delivered free nearest station, approval, cash with order.—Bickell, Westcott, Tavistock.

MASSEY-HARRIS ALL-METAL HAY AND STRAW ELEVATOR with Wolseley engine fitted, has never been used, £150.—K. D. Lovell, Netheridge Farm, Hempsted, Gloucester.

STOCKFEED POTATOES for sale.—For full details apply Horace Sullivan, Potato Merchant, 133 Widemarsh Street, Hereford.

WILD HARVEST THRESHER, new 1949, overhauled by makers, 1950, to include all latest improvements. Excellent order. Selling as getting larger combine.—Fitzgerald, Holmbush Farm, Newdigate, Surrey.

ALTERNATORS, Diesel Sets, Electric Motors, Switchgear, Transmission Equipment, Fluorescent Lighting and Industrial Fittings, ex-stock. Keen prices.—Contact G. L. Murphy Ltd., Menston, Nr. Leeds.

BRAKES for trailers. Ref. Compulsory requirements of Brakes for Agricultural Trailers (see S.R. & O. 1947, No. 670). Providing axles in service are standard agricultural types with three-stud, five-stud or six-stud roller bearing hubs, and in good condition, we can convert to brakes at very reasonable prices. Farmers, Contractors and Agricultural Engineers are invited to send us their enquiries.—Rubber By-Products (Warwickshire) Ltd., 86 Holloway Head, Birmingham 1. Phone Midland 3475.

ANALYSIS. Rapid Routine Analysis. Specialised Analysis. Ultimate Analysis. Assays. All Assays according to British Pharmacopoeia and Codex Bacteriological Examinations.—Write for particulars to Newchem Ltd., Poynton, Cheshire.

NO. 2 MIRACLE MILL complete with direct-coupled 35-h.p. Brook Motor. Reason selling installing No. 4 mill same make. Condition as new. Cost £490, accept £450 or near offer.—Box 5008.

LAND-ROVER, 1950 (Apl.), mileage 9,000; in exceptional condition. Land-Rover, 1948 (Nov.), milage 16,000; a very reasonably priced attractive vehicle.

The above are examples from the finest stock of reconditioned guaranteed Land-Rovers and ancillary equipment in the country.—Harvey Hudson, Ltd. (The Land-Rover Specialists), High Road, South Woodford, London, E.18. Tel.: Wanstead 0056.

NEW PERKINS P.6 ENGINES. Reconditioned Fordson Major tractors, fitted with brand new Perkins P.6 diesel engines on new pneumatics, with electric lighting and starting, and wheel weights, with full six months' guarantee; delivered by road to any part of the country; will take your old tractor in, in part exchange; cash or hire purchase terms.—Ernest Doe & Sons Ltd., Ulting, Essex. 'Phone: daytime, Hatfield Peverel 311; night, 314.

THE L.E.C. VAPORISER will make your Fordson Tractor last longer and will reduce your costs. 7,000 sold. Loddon Engineering Co., Ltd., Loddon, Norfolk. Phone, Loddon 214-316.

TARPAULINS. Reconditioned Waterproof Railway, 70 sq. ft. 30s., 140 sq. ft. £3, 280 sq. ft. £6 6s.; Ship, 70 sq. ft. 35s., 140 sq. ft. £4 10s., 240 sq. ft. £8 15s. Approx. 360 sq. ft. £10 10s., 720 sq. ft. £20. All include carriage. Light, medium or heavyweight as desired. Clothing, Cameras, Toys, Binoculars, Watches, etc. Free Lists, Terms.—Headquarter & General Supplies, Ltd. (F.S.B.C.), 196-200 Coldharbour Lane, Loughborough Junction, London, S.E.5. Open all Saturday.

ALUMINIUM ALLOY. New flat sheets, 6 ft. × 3 ft. 24 gauge; 6 tons from 22s. 6d. per sheet, 1 ton or more 2s. 9d. per lb., carriage paid or delivered ex-stock.—D. McMaster & Co., Ltd., Bures, Suffolk. Tel.: Bures 351/2.

CLASSIFIED ADVERTISEMENTS

MISCELLANEOUS SALES

TRACTOR TYRES. Immediate delivery makers' remoulds. Following sizes only: 550 × 16, £4; 750 × 18, £6 11s. 11d.; 750 × 20, £8 11s. 3d.; 10 × 24, £13 4s. 7d.; 10 × 38, £19 0s. 8d.; 13 × 28, £23 3s. 10d.; 14 × 30, £33. Carriage extra, 5s. per small tyre, 10s. per large tyre.—Brisbane, Station Garage, Knighton, Radnorshire.

F. H. BURGESS (GLOUCESTER), LTD., offer a completely reconditioned Caterpillar '22.' Reconditioning includes new track chains, pistons and liners, reground crankshaft and bearings, all gaskets, etc. Immaculate condition. £550.—Apply Kingsholm Road, Gloucester. Tel. 23265.

GENERATORS, 2.75 k.v.a., 230-volt, 50-cycle single-phase A.C., complete with voltmeter, volts regulator, ammeter, frequency meter, safety overload, etc., £42 10s., or complete with Scott engine £50; Coventry-Climax 2.75 k.v.a. sets, £85. Many others, lists free.—'Young's,' 32 Tooting Bec Road, London, S.W.17. Tel.: Balham 7791.

FARMERS STORAGE AND IMPLEMENT SHEDS. We can supply curved Asbestos Units, size 30 ft. long × 18 ft. wide. No steel framing required. Easy erection. Price ex-works, £59 10s. Radius of supply, Southern and London Counties.—Hill Construction Company, Wide Lane, Swaythling, Southampton.

FIELD MARSHALL, Series II, October, 1949. In perfect condition. Fitted with Cab. Can be seen working. Three months' warranty. Nearest £470.—Apply Mr. G. E. Pick, Great Dalby, Melton Mowbray, Leics.

JOHN DEERE, Model 'A' Tractor on pneumatics, fully reconditioned and guaranteed; Rowcrop model with lift, p.t.o. and pulley.—Best offer to J. Brittain Pash, Ltd., Navigation Road, Chelmsford.

LAND ROVER (1950 models) in guaranteed condition, choice from £375.—Richard Taylor (Garages), Ltd., Victoria Street, Stourbridge, Worcs. Tel.: Stourbridge 5171.

JEEPS. New and reconditioned in stock, amphibious Jeep spares.—Davies & Groves, 1-5 Dorset Close, N.W.1. Tel.: Pad. 8345. Established over 100 years.

ALTRINCHAM JUTE, LTD., sack and bag merchants and manufacturers of every description, 25 Viaduct Road, Broadheath, Altrincham, Ches. Phone Altrincham 4360.

J. HARRISON CARTER LTD., Dunstable, have for disposal a number of new electric motors of various capacities.

MISCELLANEOUS SALES

PERRY'S offer immediate delivery of reconditioned and good used Fordson Tractors, including one machine fitted with new roadless half tracks; also new P.B. potato harvester, Barford mounted potato spinner, Cooke heavy duty winch, Blanch Snook all-crop loader, etc.—Write or 'phone for full list.—W. Harold Perry, Ltd., Main Fordson Tractor Dealers, 1107-9 High Road, Whetstone, London, N.20. Tel.: Hillside 6621 (5 lines).

1948 FISHER HUMPHRIES 54 in. THRESHER on pneumatics and ball bearings with chaff and cavings blowers. Done little work, perfect condition; good reason for sale.—Apply W. Clifton, Manor Farm, Sutton St. James, nr. Spalding, Lincs. Tel.: Sutton St. James 231.

MISCELLANEOUS

BELTING, rubber and canvas, finest quality, per foot: 3-ply—2 in. 2s. 3d., 2½ in. 2s. 10d., 3 in. 3s. 5d.; 4-ply—3 in. 4s. 6d.; 3½ in. 5s. 3d., 4 in. 6s. Also endless threshing belts.—Write for price list and sample. Birmingham Belting Co., Ltd. (Dept. F), Snow Hill, Birmingham, 4.

'GOOD Oil Does Not Wear Out.' Our reclaimed oil from known high-grade origin is better than many cheap oils. 5-gallon taper neck drums: Med. X, 22s. 6d.; Med. XX, 26s. 3d. Carr. paid; reduction quantities. List.—R. W. Hey, Blyth Road, Maltby, Yorks.

'ADD Zest to Your Engine.' 'ZEST,' U.C.L. and Tune-up gives extra power to every engine. 1 gallon (£1 carriage paid) treats 300 gallons petrol or 260 gallons vaporising/fuel oil. Immediate delivery, satisfaction guaranteed.—British Solvent Oils, Ltd., 44 King Street, Manchester, 2.

ALL CLASSIFIED ADVERTISEMENTS MUST BE PREPAID. ADVERTISEMENTS WILL NOT APPEAR UNLESS COPY IS RECEIVED BY THE 6th OF THE MONTH PRECEDING PUBLICATION

MISCELLANEOUS

SACKS and bags. You want the best type and quickest delivery.—Write John Braydon, Ltd., 230 Tottenham Court Road, London, W.1. Tel.: MUSeum 6972.

MODERN self-drive cars and fully equipped caravans for hire. Write stating date of leave, make and h.p. required to Vacation Cars (Derby), opp. L.M. Region Railway Station, Derby.

FOR HIRE.—Caterpillar D.4 crawler type tractor, Caterpillar D.8, Caterpillar D.7, International T.D.14, International T.D.9, International T.D.6, with or without Bulldozing equipment. Long or short periods. With or without drivers.—Southwell Motor Co., 21 King Street, Southwell, Notts. 'Phone Southwell 3125.

CIDER. Those interested in cider making should read 'The Principles & Practice of Cider Making,' by Dr. V. L. S. Charley, price 36s., post free. Prospectus available from the publishers, Leonard Hill Limited, Stratford House, 9 Eden Street, London, N.W.1.

PETROL AND DIESEL ENGINES RECONDITIONED. Diesel fuel pumps, injectors and carburetters overhauled. Crankshaft and cylinder grinding, sleeving, bearing remetalling and boring in line, internal and surface grinding, cylinder head repairs and other precision work. Exchange engines, crankshaft assemblies, carburetters, etc., available from stock. Let us quote for your requirements.—Bristol Motor Co., Ltd., Bristol, 3. Phone, Bristol 64013.

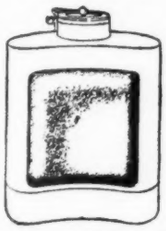
TRACTOR TYRES. We can still supply a limited number of guaranteed, heavy treaded, rebuilt tyres, with one year's guarantee, as follows, carriage paid, 7 days' approval against cheque, delivery 7 days: 9.00 × 24, £17 2s.; 11 × 36, £19 4s.; 11.25 × 24, £19 4s.; 11.25 × 28, £22 3s. 6d.; 10 × 28, £15 15s. 6d.; 14 × 30, £30 15s.; 11 × 38, £22 3s. 6d.; 14 × 34, £36 12s.; also other sizes. Allowance or we buy your old sound casings at £4 each, most sizes.—Llewellen's Direct Tyre Service, Agricultural Tyre Specialists, Commerce House, 6 Victoria Terrace, Leeds, 3. Tel. 23426.

"DRON-WAL" Supreme SPRAYERS & SYRINGES for All Purposes of Pest Control, Trees, Ground Crops, Cattle, Malaria, etc.

SYRINGES, SPRAYERS AND PUMPS OF ALL DESCRIPTIONS
HOSE FITTINGS, POWDER BLOWERS, ETC.

KNAPSACK SPRAYER IN COPPER
COPPER TIN COATED OR BRASS CONTAINERS
Rubber Pad can be fitted if requested as illustrated

Illustrating Patent Diaphragm Pump Action
CAM AS FITTED TO ALL KNAPSACK SPRAYERS
Patent No. 626777



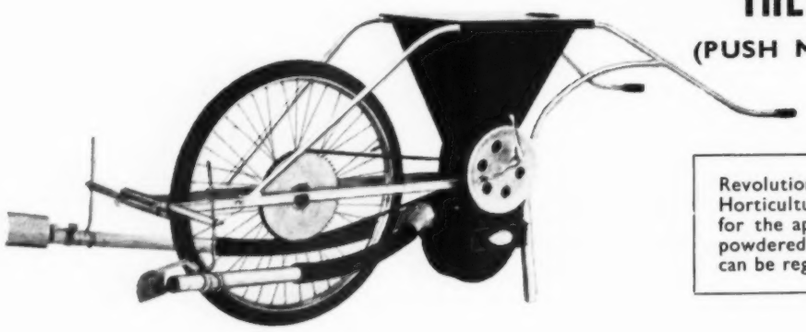
PATENT RUBBER PAD
CATALOGUES ON REQUEST

No. 8
'EASI-FILL' COMPRESSED AIR SPRAYER
IN 2, 3 AND 4 GALLON SIZES
BRASS OR GALVANISED CONTAINERS

The PHILIP B. WALDRON CO., Kings Road, Tyseley, BIRMINGHAM 11 Telegrams Dron-Wal, Birmingham

THE PESTMASTER MINOR

(PUSH MODEL) DUSTING MACHINE



Revolutionary in its usefulness to the Farmer and Horticulturist, this all-in-one machine is suitable for the application of insecticides, fungicides and powdered fertilisers. The distribution of powder can be regulated to suit all requirements.

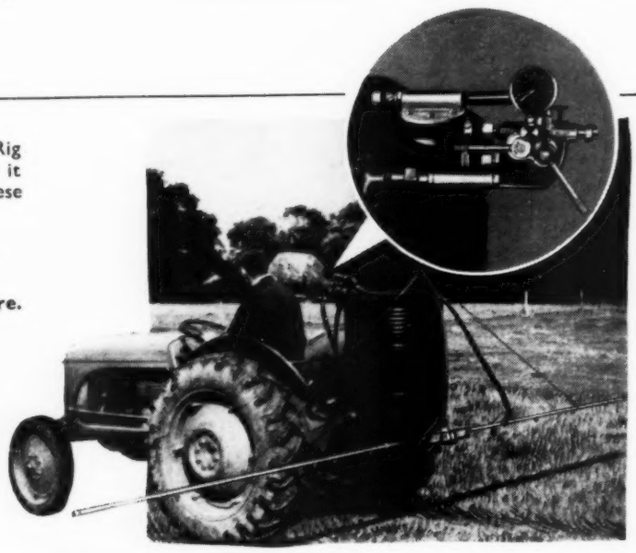
One of the famous Allman productions, the Genimec Spray Rig takes any 40-gallon barrel or the standard honey barrel, and it gives you economical precision spraying because it has these three other great advantages :

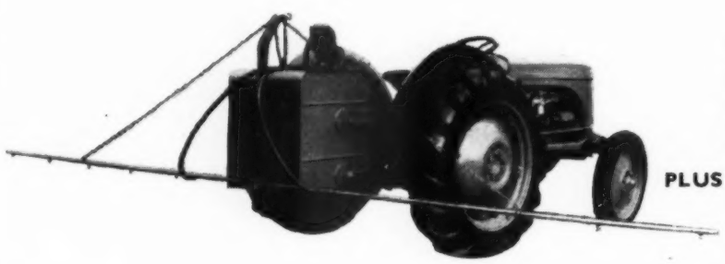
- **Genimec Finger-Tip control for pressure regulation.**
- **Boom selection and automatic nozzle cleaning.**
- **Continuous hydraulic agitation under regulated pressure.**

GENIMEC

SPRAY-RIG

PATENTED





ALLMAN 'PLANTECTOR'

HIGH/LOW VOLUME SPRAYER

Here is a sprayer whose great features have made it a number one choice with farmers everywhere! Its star feature is the Genimec Finger-Tip Control, an ingenious pre-set device that ensures perfect pressure regulation, *i.e.* hydraulic agitation, boom selection and automatic nozzle cleaning.

PLUS

- **High Duty Bronze Gear Pump.**
- **Filter with Interchangeable Packs for Solutions or Suspensions.**
- **Filter in every Spray Jet.**
- **Light Chains for Lifting Booms.**
- **Drop Legs that can be supplied for Under-Leaf Spraying.**

Write for illustrated folders TODAY!

HOME SALES :

E. ALLMAN & CO. LTD.,

BIRDHAM ROAD · CHICHESTER · SUSSEX · ENGLAND

Telephone : BIRDHAM 353-4

EXPORT DIVISION :

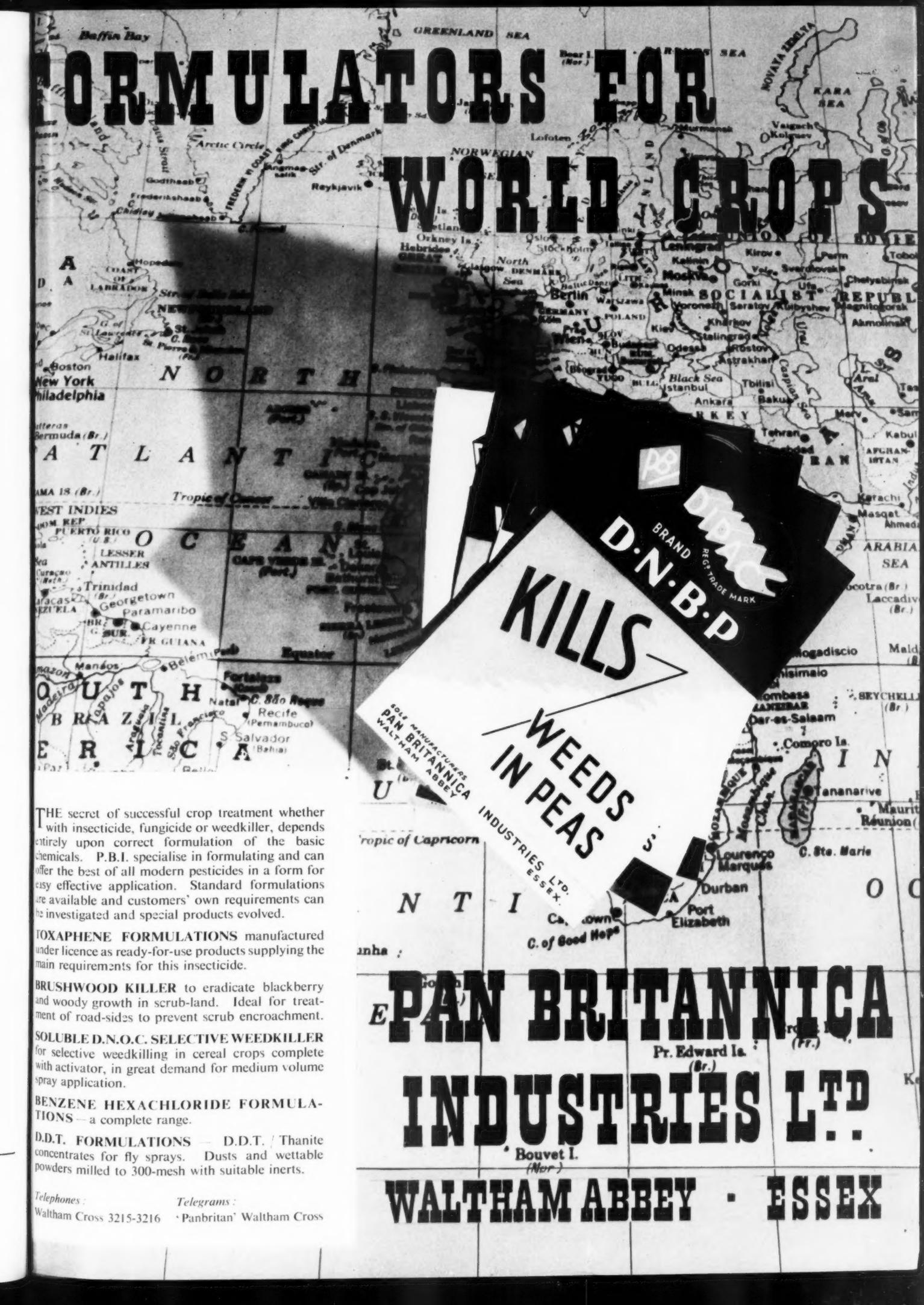
ALLMAN OVERSEAS LTD.,

BURY COURT HOUSE · BURY COURT · LONDON · EC3

Kill the pests that eat your profits

Printed for the Proprietors, LEONARD HILL LIMITED, and published by them at their Offices, Stratford House, 9 Eden Street, London, N.W.1 by F. J. Parsons, Ltd., London and Hastings, England.
Registered for Transmission to Canada, including Newfoundland.

FORMULATORS FOR WORLD CROPS



THE secret of successful crop treatment whether with insecticide, fungicide or weedkiller, depends entirely upon correct formulation of the basic chemicals. P.B.I. specialise in formulating and can offer the best of all modern pesticides in a form for easy effective application. Standard formulations are available and customers' own requirements can be investigated and special products evolved.

TOXAPHENE FORMULATIONS manufactured under licence as ready-for-use products supplying the main requirements for this insecticide.

BRUSHWOOD KILLER to eradicate blackberry and woody growth in scrub-land. Ideal for treatment of road-sides to prevent scrub encroachment.

SOLUBLE D.N.O.C. SELECTIVE WEEDKILLER for selective weedkilling in cereal crops complete with activator, in great demand for medium volume spray application.

BENZENE HEXACHLORIDE FORMULATIONS — a complete range.

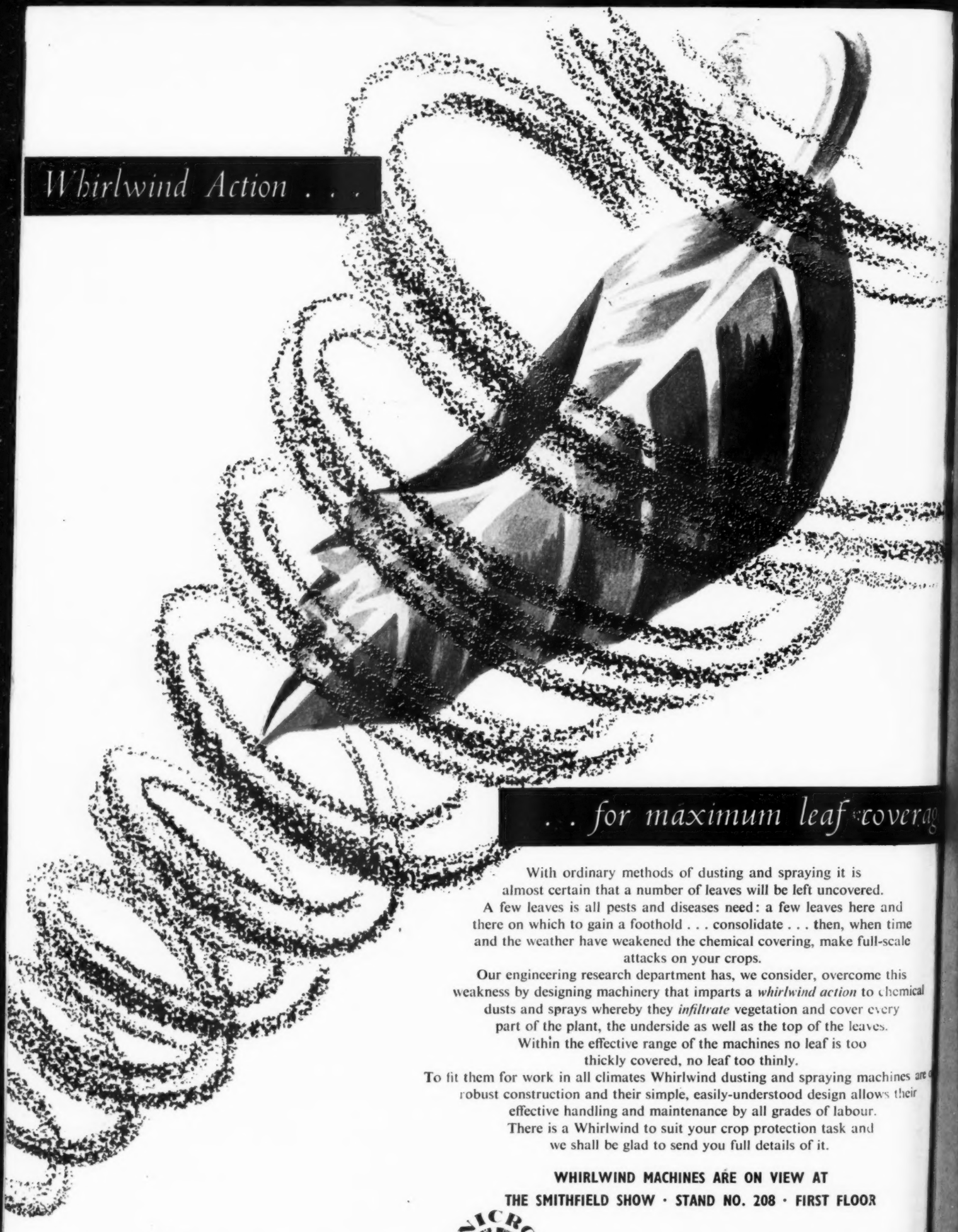
D.D.T. FORMULATIONS — D.D.T. / Thanite concentrates for fly sprays. Dusts and wettable powders milled to 300-mesh with suitable inerts.

Telephones: Waltham Cross 3215-3216

Telegrams: 'Panbritan' Waltham Cross

PAN BRITANNICA INDUSTRIES LTD.

WALTHAM ABBEY · ESSEX



Whirlwind Action . . .

. . . for maximum leaf coverage

With ordinary methods of dusting and spraying it is almost certain that a number of leaves will be left uncovered. A few leaves is all pests and diseases need: a few leaves here and there on which to gain a foothold . . . consolidate . . . then, when time and the weather have weakened the chemical covering, make full-scale attacks on your crops.

Our engineering research department has, we consider, overcome this weakness by designing machinery that imparts a *whirlwind action* to chemical dusts and sprays whereby they *infiltrate* vegetation and cover every part of the plant, the underside as well as the top of the leaves. Within the effective range of the machines no leaf is too thickly covered, no leaf too thinly.

To fit them for work in all climates Whirlwind dusting and spraying machines are of robust construction and their simple, easily-understood design allows their effective handling and maintenance by all grades of labour.

There is a Whirlwind to suit your crop protection task and we shall be glad to send you full details of it.

WHIRLWIND MACHINES ARE ON VIEW AT
THE SMITHFIELD SHOW · STAND NO. 208 · FIRST FLOOR

UNIVERSAL CROP PROTECTION LTD.

UNICROP AGRICULTURAL CHEMICALS

BALTIC HOUSE, LEADENHALL STREET, LONDON, E.C.3 · TELEPHONE: ROYAL 5611 · CABLES: UNICROP, LONDON